

Popular Science

★ FOUNDED **MONTHLY** 1872

INVENTIONS
—
DISCOVERIES
—
RADIO
—
AUTOMOBILES
—
AVIATION
—
HOME WORKSHOP



JANUARY

How to make the new and thrilling winged toboggan. *Page 72*

25 CENTS

Inventions I Hope to Make—*Edison*

Copyrighted material

No matter what set you buy, be sure the dealer puts in *genuine* Radiotrons:

UV-199	\$2.50
UX-199	\$2.50
UX-120	\$2.50
UV-201-A	\$2.50
UX-201-A	\$2.50
UV-200	\$2.50
UX-200	\$2.50
WD-11	\$2.50
WD-12	\$2.50
WX-12	\$2.50
UX-112	\$6.50
UX-210	\$9.00

Rectrons:

UX-213	\$7.00
UX-216-B	\$7.50

A "UX" or "WX" tube is the same as the corresponding "UV" or "WD" tube, except in the design of the base.



©

Radiotron UV-201-A, standard high-vacuum tube for storage battery sets.

For every Christmas Radio Set use only genuine RCA Radiotrons

READ all the claims of all the makers of radio sets—and then remember this when you buy—that getting what is claimed for a set depends upon the quality of the *vacuum tube* put into it. You cannot get clearness—you cannot get distance—you cannot get volume—unless the *tubes* get it. That is why it is so important to look at the base of every tube, to be sure it is a *genuine* RCA Radiotron.

A great gift for any fan—at \$2.50

A radio fan will appreciate a "spare" Radiotron, just as an autoist appreciates a spare tire. But the Radiotron—a genuine RCA Radiotron—costs only \$2.50. If you note what make of set a man owns, any dealer can tell you which *type* of Radiotron he uses, and you can give him exactly what he would choose for himself.

for owners of Super-Heterodynes — the new power tube

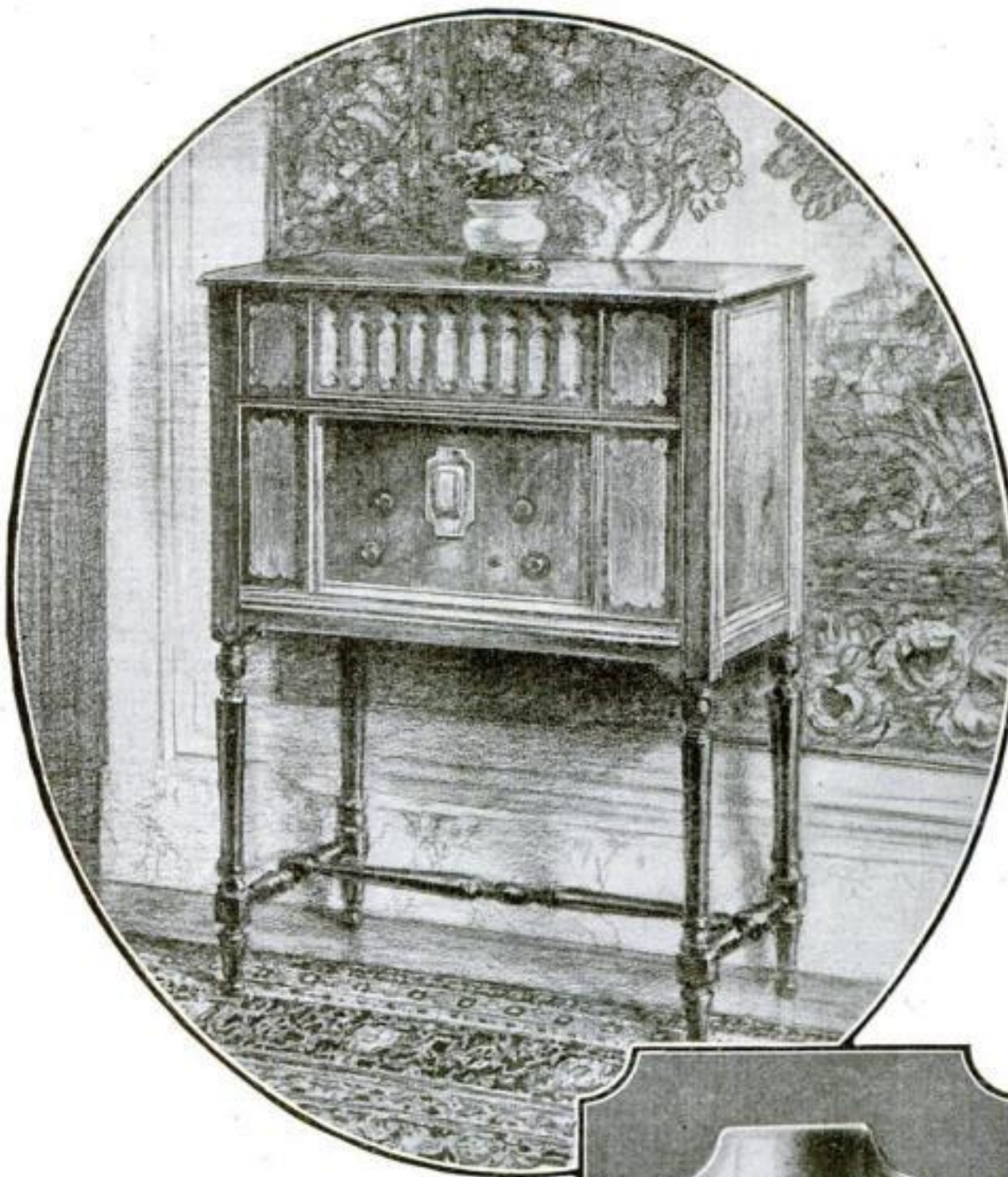
Every owner of a Radiola Super-Heterodyne can bring his set right up-to-date with the latest improvement, if you give him the new dry battery power Radiotron UX-120, and the adapter. The adapter costs but \$1.50. And this new tube means great volume with better tone than ever!

RADIO CORPORATION OF AMERICA
CHICAGO NEW YORK SAN FRANCISCO

RCA-Radiotron

MADE BY THE MAKERS OF RADIOLAS

How Kolster Reveals RADIO'S "LOST CHORDS"

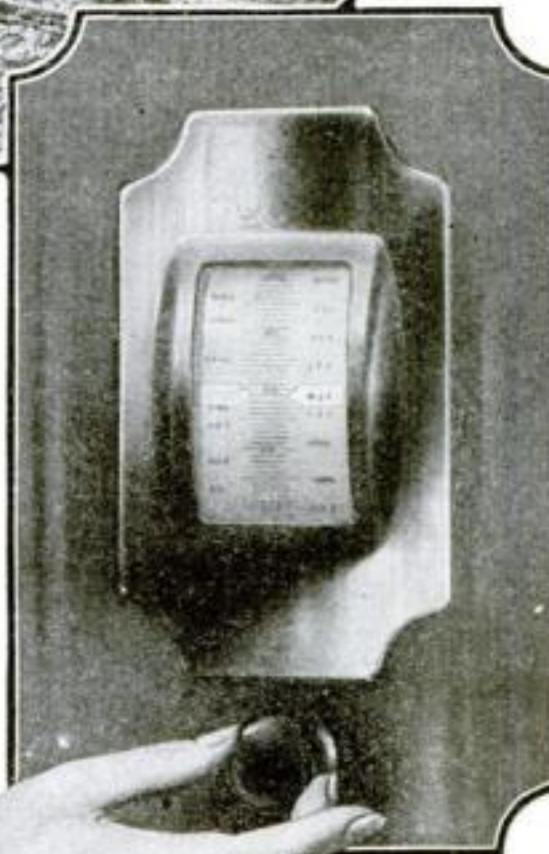


Model 6-C is a six tube, antenna set, loud speaker enclosed, ample space for rectifier and all batteries.

A Parade of Stations

One station after another parades by as you turn the Kolster regulator.

Whatever is on the air comes in easily, perfectly.



Subtle overtones now developed. A wondrous achievement in tonal perfection

Reproduction such as you've never heard before.

The climax in reception, the ideal in reproduction.

Your ear will instantly detect Kolster superiority.

You'll recognize a broader range of notes, all the delicate shadings and individuality.

If Zimbalist plays, it is Zimbalist—as if you were actually in the studio. There is no interference, no muffling, no exaggerations or repressions.

If the President makes a speech, if McCormack sings, if Lopez jizzes, if Godowsky plays the piano—

—whoever or whatever is broadcast is reproduced faithfully.

A Kolster neither adds to nor subtracts from broadcasting.

So now comes new reality. All the rich tonal coloring in its natural beauty—not mere sound but vivid, lifelike.

And all with simplicity. Just turn from one station to another. The Kolster has a single control. No "tricky" tuning with numerous dials. No chart of strange numbers.

Free from interference. No howls. No background noises. No overlapping of stations.

In short, the radio you've expected. The refinements you've wanted. Radio at its best.

To hear a Kolster gives a new thrill. It sets new standards.

Hear the Kolster in your own home or at a Kolster dealer's shop. Five beautiful models. De luxe, but not expensive.

FEDERAL TELEGRAPH COMPANY
(of California)

Woolworth Building, New York City

KOLSTER RADIO

Popular Science Monthly

The Magazine of Invention and Discovery

JANUARY, 1926; Vol. 108, No. 1

25 cents a Copy; \$2.50 a Year



Published in New York City at

250 Fourth Avenue

Features in This Issue

ALL outdoors is the studio of Remington Schuyler, the noted American Indian painter; but nowhere, we think you will agree, has he portrayed the tingling thrill of winter more masterfully than in the painting on the cover of this issue. If this picture makes you want to build a winged toboggan and try it on the nearest hill, your enthusiasm will be doubled when you read the graphic description of this fascinating new winter sport by its originator. Turn to page 72.

WHETHER clothes make the man or not, it is fairly certain that spotted and shabby clothes never get a man very far. For every one who values the measure of self-respect to be drawn from a neat appearance, the article by an expert dry cleaner on page 23 holds a wealth of useful information on a little understood subject.



The autogiro, amazing flying machine, that flaps its wings like a bird, described on page 13 of this issue

AFTER all that has been said and written about memory and how to improve it, a Columbia University professor at last has really hit the nail on the head on page 26 of this issue. He offers us no short cut to perfect memory. Instead he shows

us how we can manage more efficiently the marvelous filing system of our minds and so increase its working capacity.

Professor Robert S. Woodworth also cites interesting instances of men who have naturally remarkable memories.

HAVE you been caught by the hard coal shortage? There's a sure way to beat the problem, as you will learn when you turn to the article on page 34.

It tells you just how you can burn soft coal in your furnace almost, if not quite, as effectively as anthracite.

THAT often - dreamed - of achievement—vertical flight from the roofs of buildings and homes—may be brought a step nearer reality by the remarkable flying machine, the autogiro, pictured here. On page 13 you will read of its remarkable test flight.

And 200 Other Articles and Pictures, including—

	Page
Popular Science Institute of Standards.....	6
Why Curiosity Pays.....	9
By Thomas L. Masson	
The Invisible Lifeline of the Sea.....	11
By Peter Vischer	
Flaps Its Wings like a Bird.....	13
By Arthur A. Stuart	
Inventions Edison Still Hopes to Make.....	14
By John R. McMahon	
Lessons in Magic.....	16
By Houdini	
Is This the Face of Future Man?.....	19
By Ernest Brennecke, Jr.	
South American Snake Farm.....	20
By Francis Gow-Smith	
Curiosities in Sport.....	22
What a Cleaner Has Learned.....	23
By Watson G. Clark	
The 1926 Eclipse.....	25
By Newton Burke	
Is Your Memory Badly Managed?.....	26
By Robert S. Woodworth, Ph.D.	
When Trains Crash.....	28
By Truman Stevens	
Prize-Winners in the August Contest.....	31
Where Old Houses Go.....	33
When Burning Soft Coal.....	34
Tracking the Killer by His Bullets.....	36

	Page
Mechanical Farm Hand Milks Cows.....	38
Paper Boards and Boxes from Waste.....	38
Boys Build Scenic Railway.....	39
American Home Shipped to France.....	39
Auto Carries Wire Cutter.....	40
Taking a Sawmill into the Forest.....	40
Know Your Car.....	40
Powder Puff Can Be Changed Easily.....	41
"Vacuum Cleaner" Unloads Cargoes.....	41
Oddities on Wheels.....	42
Queer Boats and Their Skippers.....	43
Paris Has Moving Sidewalks.....	44
Fresh Coffee for Every Customer.....	44
Five-Pound Motion-Picture Outfit.....	44
Reflectors Teach how to Draw.....	45
Styles in Industrial Gas Masks.....	45
Science Is Putting New Ideas to Use.....	46
Unusual Products of Handicraft.....	48
Have You Seen Them Any Bigger?.....	49
Camp Fire Girl Made of Butter.....	50
Lighthouse Is a Radio Set.....	50
Where Roots Are Dug for Pipes.....	50
Cycle Car from Airplane Parts.....	51
Four Bottles Support an Elephant.....	51
Traveling Dolls Teach First Aid.....	51
Radio Set Made into a Book.....	51
Newest Marvels of Aviation.....	52
He Fries Eggs on Ice.....	54

	Page
Boat Guided by Beam of Light.....	54
Automatic Music Turner.....	54
Foot Toboggans a Novel Sport.....	54
He Invents New Golf Game.....	55
Embossing Machine Aids Blind Printers.....	55
Canvas "Lap" Gathers Fruit.....	55
Traffic Cop a Semaphore.....	55
16 Answers to Housewives' Problems.....	56
Coins Sorted and Counted Automatically.....	58
Collar Clasp Lies Flat.....	58
Rod Holder for Lazy Fishermen.....	58
Pencil Writes in Five Different Colors.....	59
Measuring Wear on Trousers.....	59
Charcoal Gas Substitute for Gasoline.....	59
A Loudspeaker You Can Build.....	60
By Alfred P. Lane	
Unusual Hook-Ups and Ideas in Radio.....	62
What 10,000,000 People Like to Hear.....	63
New Auto Fittings.....	65
How to Paint Your Car.....	66
By Martin Bunn	
Useful Hints for Car Owners.....	68

Home Workshop.....71
Better Shop Methods.....76

And Other Timely Articles and Pictures

POPULAR SCIENCE MONTHLY

Issued monthly. Single copy, 25 cents. Yearly subscription to United States, its possessions, and Canada, \$2.50; foreign countries, \$3. Entered as second-class matter Dec. 28, 1918, at the Post Office at New York under the act of March 3, 1879; additional entry as second-class matter at Dunellen, N. J. Entered as second-class matter at the Post Office Department, Canada. Printed in U. S. A. Copyright 1925, by the Popular Science Publishing Co., Inc. The contents of

this magazine must not be reprinted without permission. In presenting in its editorial columns numerous stories of new products of applied science, POPULAR SCIENCE MONTHLY does not underwrite the business methods of the individuals or concerns producing them. The use of POPULAR SCIENCE MONTHLY articles, or quotations from them for stock-selling schemes is never authorized. O. B. Capen, President and Treasurer; R. C. Wilson, Vice-President; A. L. Cole, Secretary.

Brandes

EXPERTS IN RADIO ACOUSTICS SINCE 1908



The Brandes Cone—a truly decorative bit of furniture that conceals a remarkable speaker.



The Type H—a horn of graceful lines and antique green and black finish. Great in volume—true in tone. Adjustable.



The Brandes Cabinet of mahogany, finished in walnut brown. The same unit, quality of tone and even greater volume than the Type H Speaker.



The Adjustable Table-Talker. Gooseneck horn. Finished in brown—felt-padded base. Adjustable. A most satisfactory buy.



The Superior Matched Tone Headset is now, as always, ideal to tune in with—to listen undisturbed and undisturbing. Offered at a new low price.



The Audio Transformer—amplifies at an unusually high ratio—1 to 5. Two steps of amplification may be used without transformer distortion.

Send for an interesting booklet describing Acoustics by Brandes.

Brandes Products Corp.
200 Mt. Pleasant Ave.
Newark, N. J.



The Phonograph Attachment—a splendid speaker with any good phonograph. Same unit as Type H horn. Adjustable and furnished with a connection to fit all phonographs.

The new Brandes speakers—perfected now after many busy years of experiment—give new clarified mellowness to the low tones, new rounded sweetness to the high.

Be sure your set is in its best voice—always—with acoustics by Brandes.

© Copyrighted by
Brandes Products Corp.—1926

*Are You
Looking for*

OPPORTUNITY?

Turn to Pages 120 to 150

You'll find in our new section
"Money-Making Opportunities"
just the Opportunity you seek!

DO YOU WANT to make money?
Are you dissatisfied with your
job, your salary, your future?
Do you envy those who are
better paid than you?

There's just one sure way to get ahead, to climb out of the small pay rut—and that way is through Training. And there are several ways to get the right kind of training for the job you want to fill—through home study from a reputable correspondence school, through technical books, or through a short course in a residence trade school.

A New Service to Readers of Popular Science Monthly

Popular Science Monthly is the meeting place for those who want training and those who are expert in giving it. Thousands of men and boys have been started on the road to greater earning power through advertisements in this magazine.

Now, as an added service to you—to make it easier for you to decide on the training you wish—we have grouped all advertisements of this kind in our new section, "Money-Making Opportunities." You'll find it on pages 120 to 150 of this issue.

It will pay you to turn to these pages—to read over carefully the advertisements of schools and books covering the field in which you are most interested—and then to act! Choose the line of work that appeals to you most, and write to the advertisers in that line for full particulars of their training.

How Thousands Have Already Won Success

Men with no experience, with little education, with nothing to help them but their own ambition to be somebody, have found success through ads in Popular Science Monthly. They saw the announcements of courses of training here. They sent the coupons, decided which offered them the best opportunity, and then, through the training they received, rose quickly to positions of responsibility and greater earning power.

Clerks have become star salesmen—farm boys have become electrical experts—bookkeepers have become expert accountants. Men who had never before been able to earn more than \$25 or \$35 a week, are now making \$50, \$75, \$100 and more. And they don't work half so hard. But they are trained men—specialists in their field—and it's trained specialist, not the unskilled and untrained worker, who gets the big money.

You Risk Nothing When You Write for Details

You can get all the facts about any Course of training advertised under "Money-Making Opportunities" without the slightest obligation to yourself.

Hence you don't risk a thing when you answer an advertisement of training in Popular Science Monthly. You will lose nothing—and you open up for yourself bigger opportunities, a bright future, more and better chances to earn big pay, than you ever had before.

What Others Have Done You, Too, Can Do!

The men who found success through Popular Science ads aren't any smarter or more ambitious than you. They only had the same opportunity that you have now. They simply decided what they wanted to do—and then did it.

Make your decision today. Be a "doer"—not a "wisher." Start now to study the "Money-Making Opportunities" on pages 120 to 150 of this magazine. It may be the turning point of your life!

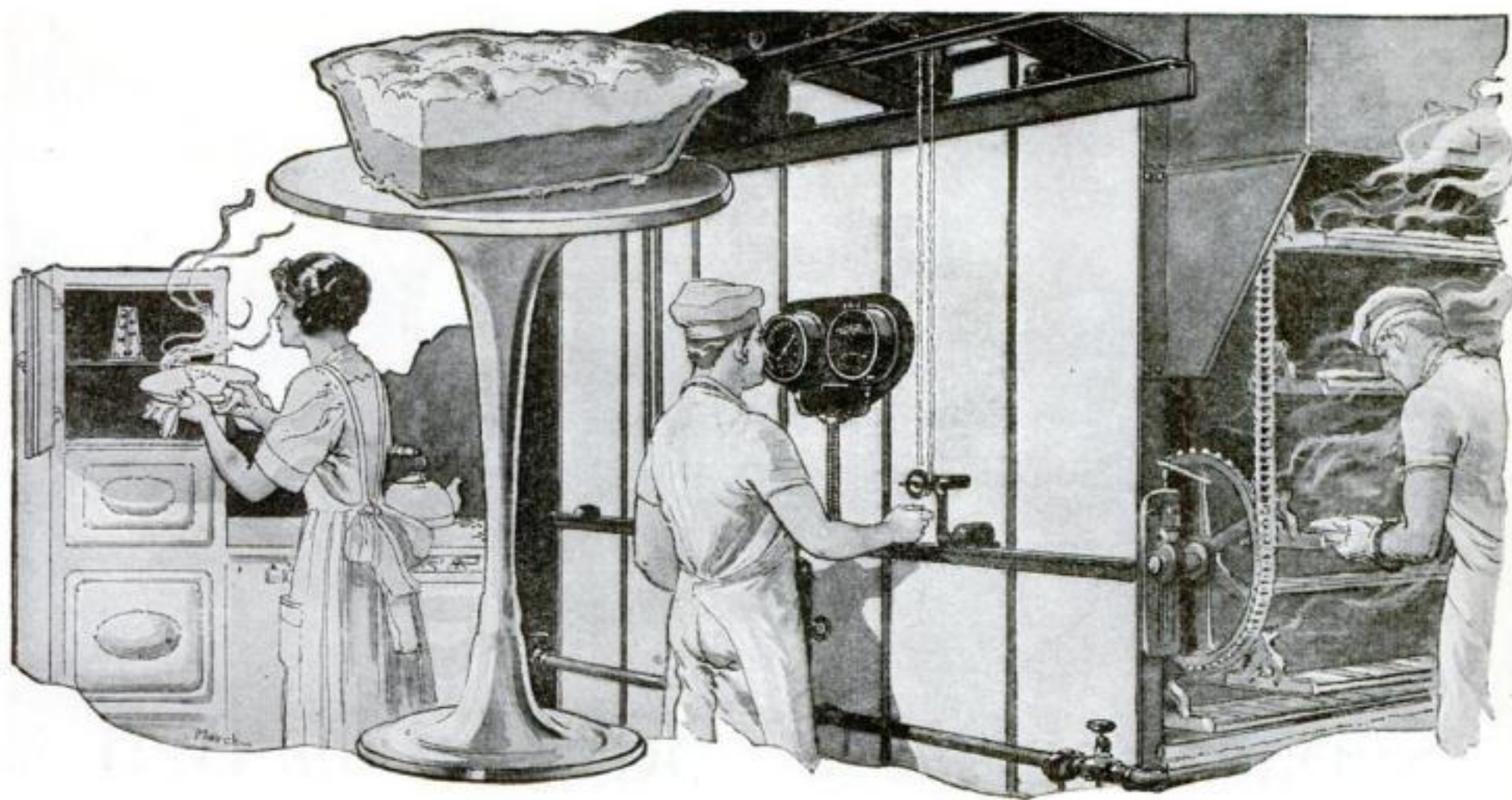
It will pay you to
read, "Money-Ma-
king Opportunities"

[PAGES 120 to 150]

**\$100 in
Prizes!**

FULL DETAILS OF THIS BIG
OFFER AND THE WINNERS
IN LAST MONTH'S CONTEST
WILL BE FOUND ON PAGE 120

"What's Your Future?" Get started now on the
Road to Success—see pages 120-150



Pies Made the Tycos Way

THOUSANDS of pies a day, hundreds of thousands a year—every one with crisp, flaky crust and the filling baked just right.

Uniformity in product, the all essential in modern baking on a quantity basis, is made possible by the use of *Tycos* Electric-Contact Temperature Control. No longer do bakers depend on the labor-wasting hand adjustments of the gas valve with the inevitable variations in temperature that means spoilage and delays in delivery. The uniformity that bakers get can be had in home baking if the Taylor Oven Thermometer is used.

Guesswork and uncertainty in baking and in every other industry employing heat processes have been eliminated by the use of *Tycos* Instruments for Indicating, Recording and Controlling Temperatures—the Sixth Sense of Industry.

If you use heat in your manufacturing processes—whether for making armor-plate or baking enamel on cuff buttons, for making rubber tires or hatching eggs or making paints, metalware, furniture or any other product that goes through heat treating processes, you need in your plant *Tycos* Instruments for Indicating, Recording and Controlling Temperatures.

To Manufacturers

Tycos Engineers have effected substantial economy for manufacturers in every line of industry by applying the *Tycos* "Sixth Sense." Whatever your problem in the indicating, recording or controlling of heat, there is a *Tycos* Instrument to serve you. Write us for literature on any instrument, or type of instrument, and it will be sent promptly. Or, if you prefer, our engineers will consult with you on the application of the *Tycos* Sixth Sense in your plant.

Taylor Instrument Companies

Main Office and Factory

ROCHESTER, N. Y. . . . U. S. A.

Canadian Plant: *Tycos* BUILDING, TORONTO

SHORT & MASON, LTD., Manufacturing Distributors in Great Britain



Tycos— for the Home

Tycos Office Thermometers
An aid in promoting human efficiency.

Tycos Bath Thermometers
To enable you to get the most good from your bath.

Taylor Home Set
Bake Oven Thermometer, Candy Thermometer, Sugar Meter. The secret of accurate results in cooking.

Tycos Wall Thermometers
To help you maintain a temperature in your house conducive to good health.

Taylor Quality Compasses
To show you the right way in unfamiliar country.

Tycos Fever Thermometers
A necessity in every home.

Tycos Stormoguide
Forecasts the weather twenty-four hours ahead with dependable accuracy.

Tycos Hygrometer
To enable you to keep the humidity of the atmosphere in your home correct at all times.

Your dealer will show them to you. Ask us, on a postal, for booklets on any of the above.

Tycos— for the Medical Profession



Tycos Sphygmomanometer, Pocket and Office types.

Tycos Urinalysis Glassware.

Tycos Fever Thermometers.
Bulletins on request.

THE SIXTH SENSE OF INDUSTRY

Tycos Temperature Instruments

INDICATING • RECORDING • CONTROLLING



Equip your set with Balkite Radio Power Units

They provide unfailing, uniform current for both circuits



Balkite Battery Charger

This popular battery charger is entirely noiseless and can be used while the radio set is in operation. If your battery should be low you merely turn on the charger and operate the set. Charging rate 2.5 amperes. Operates from 110-120 AC 60 cycle current. Special model for 50 cycles. Also for 25-40 cycles with 1.5 ampere charging rate.

Price \$19.50 West of Rockies, \$20
In Canada, \$27.50



Balkite Trickle Charger

Can be connected to the usual 6-volt battery and left on permanent (or trickle) charge. Automatically charges the "A" battery and supplies "A" current from the light socket.

With small batteries (4-volt and small 6-volt) can be used as an intermittent charger of the usual type. Or it can be used as a trickle charger if a resistance is inserted to cut the charging rate to the needs of the set.

As an added convenience to trickle charging some owners add a switch which cuts out the charger and turns on Balkite "B" during operation, making both power supplies automatic in operation.

Charging rate .4 to .5 amperes. Size 5 1/2 x 2 1/4 x 5 inches. Fits in usual dry cell compartment. Current consumption 1/10¢ per hour. Operates from 110-120 AC 60 cycle current. Special model for 50 cycles.

Price \$10 West of Rockies, \$10.50
In Canada, \$15

Equip your set with Balkite Radio Power Units. They improve and simplify radio reception. With their use your current supply is unfailing and always exactly what is required for each circuit. They reduce the amount of attention you give your set.

The popular Balkite Battery Charger is entirely noiseless and can be used while the set is in operation.

The Balkite Trickle Charger converts your "A" battery into a permanent "A" power unit that automatically supplies full "A" current at all times from the light socket.

Balkite "B" II is also well known. It was the outstanding development in radio last year. It eliminates "B" batteries and supplies plate current from the light socket. It fits any set.

The new Balkite "B" at \$35 is especially designed to serve sets of 6 tubes and less. With such sets it will perform exactly as does Balkite "B" II with sets of larger "B" current requirements.

Noiseless—No bulbs—Permanent

All Balkite Radio Power Units are based on the same principle. All are entirely noiseless in operation. They have no moving parts, no bulbs, and nothing to adjust, break or get out of order. They cannot deteriorate through use or disuse—each is a permanent piece of equipment with nothing to wear out or replace. They require no other attention than the infrequent addition of water. They do not interfere with your set or your neighbor's. Their current consumption is remarkably low. They require no changes or additions to your set. They constitute a complete, trouble-free radio power equipment, one that is economical, unfailing in operation, and eliminates the possibility of run-down batteries.

Manufactured by
FANSTEEL PRODUCTS COMPANY, Inc.
North Chicago, Illinois

FANSTEEL
Balkite
Radio Power Units



Balkite "B"

Eliminates "B" Batteries. Supplies plate current from the light socket. Operates with either storage battery or dry cell tubes. Keeps "B" circuit always operating at maximum efficiency, for with its use the plate current supply is never low. Requires no changes or additions to your set. No bulbs—nothing to replace. Requires no attention other than adding water twice a year.

A new model, designed to serve sets requiring not more than 20 milliamperes at 90 volts—practically all sets of 5 tubes or less, and most 6 tube sets. Size 8 1/4 in. long, 8 in. high, 3 1/4 in. wide. Occupies about same space as 45 volt dry "B" battery. Operates from 110-120 AC 60 cycle current. Special model for 50 cycles.

Price \$35
In Canada, \$47.50



Balkite "B" II

The most outstanding development in Radio last season. Same as the new Balkite "B" but will fit any set including those of 8 tubes or more. Current capacity 40 milliamperes at 90 volts. Size 9 in. high, 6 1/4 in. wide, 7 1/2 in. deep. Operates from 110-120 AC 60 cycle current. Special model for 50 cycles.

Price \$55
In Canada, \$75

The Unipower, manufactured by the Gould Storage Battery Company, is equipped with a special Balkite Radio Power Unit.

BALKITE BATTERY CHARGER • BALKITE TRICKLE CHARGER • BALKITE "B" BALKITE "B" II

ALL BALKITE RADIO POWER UNITS ARE TESTED AND LISTED AS STANDARD BY THE UNDERWRITERS' LABORATORIES

Supremacy

IN every industry there is some one product that by sheer merit and outstanding quality and performance is accepted as the standard by which other products may be judged.

In the Radio Industry it is the Mu-Rad Transcontinental Receiver. In this great Radio Receiver, for the first time, unsurpassed tone-quality, absolute selectivity, extreme distance and simplicity of tuning have all been perfected.

Only One Dial to Tune

MU-RAD RADIO CORPORATION

Factory: Asbury Park, N. J.

Sales Offices: Newark, N. J.

Write Dept. D-5,
for literature.



The **MU-RAD**
Transcontinental Receiver





Why Curiosity Pays

ARE you curious? Why? When? Where? In the rear of my country home in New Jersey is a miniature house, built twenty-one years ago. A small, square house with a peaked roof, about fifteen by fifteen. It remains unchanged from the time of its birth, except for a new roof. Originally it held a Franklin stove. In the dead of winter, the thermometer below zero, I could poke a few sticks of wood into that stove and in three and a half minutes the house would be so hot I would have to open the window.

I built it myself, out of curiosity plus lumber.

This house has been quite a traveler. When I moved, I took it with me to my next residence. When I bought my present home, I brought it with me. It has seen the world, has rubbed up against humanity, and has been a shelter for man and beast.

When I die I shall hope to take it with me. Not that I doubt there are still available mansions in the sky. But there might be a delay. Besides, I would want the good angels to know that I built this house myself with my own hands, and that it once saved my life. You see, I am an optimist not only about the present but the future. All on account of curiosity.

When I built it I was very ill, trying to beat tuberculosis. Friend doctor came along one day and said if I could do some work in the open air, it would help. I had seen log cabins in the mountains. Bungalows then were coming in and I had seen pictures of them.

"I am a little man," I said, "but can I build a house in my back yard?"

And they laughed at me. The fact was, I never had made anything in my life. Always a student. As a handy man about the house I was considered a hopeless mess. Every one

conspired against me. They put me in a steamer chair out in the back yard in the sun, tucked me up, and left me to my curiosity.

Could I do it? The answer was *no*. Again, could I do it? The answer was *yes*. The cumulative current of an insatiable curiosity swept me along to victory. From the day that house was finished my recovery was certain. I had the laugh on them. Curiosity is one of the greatest moving forces in the world. Curiosity killed a cat and Bluebeard's wife. It saved my life. To understand it, to control it, to develop it, to turn it on at the right moment, is to be one King Pin among just the few at the top. The ladder of success is built on interrogations. Let me suggest a method.

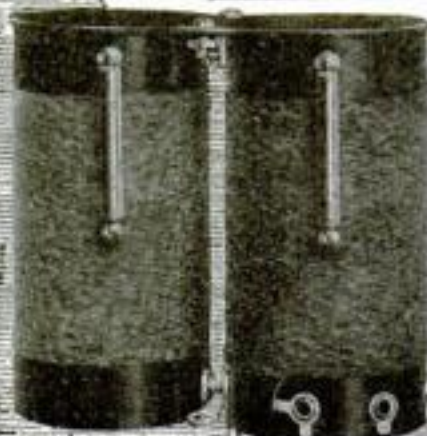
IDLE curiosity almost always occupies itself with single objects, and is a waste of time. *Right curiosity* concerns itself with principles of conduct. Material objects and results follow inevitably. My question "Can I build a house?" was answered eventually by the house itself. Result: Health.

In many cases, it takes courage to be curious. But it pays the biggest returns in the world. When any problem presents itself—physical, financial, domestic, or educational—question it, be curious about it. The mere fact of formulating a question starts you on the road to the true answer.

Here are four sample questions. They can be multiplied indefinitely. It is one of the most interesting and profitable games: Why am I too thin? Why am I too fat? What makes me bashful? What makes me timid?

When we introduce an interrogation point into our minds, it is like a bloodhound on the trail—it never lets up until the answer is treed.

—THOMAS L. MASSON.



Grebe Low-Wave Extension Circuit
Pat. 1,570,000

Can Your Set Receive All Stations?

OVER 100 stations are broadcasting on less than 240 meters. How many are beyond the reach of your set? The Synchronphase can get them all.

Grebe Low-Wave Extension Circuits make possible a range of from 550 down to 150 meters. This is accomplished by an automatic switch which enables one dial to cover two wave ranges. The first, from 550 to 240 meters, corresponds to the practical tuning range of the usual set. The second overlaps this and extends down to 150 meters. To change from one range to the other is simplicity itself. Simply move the center dial past the 100 mark for the high range and beyond the zero mark for the low range.

The Synchronphase is thus well-equipped to take care of future station assignments as well as all present ones.

Ask your dealer to demonstrate this and other Grebe advances in radio development

A. H. Grebe & Co., Inc., 109 West 57th St., New York

Factory: Richmond Hill, N. Y.

Western Branch: 443 So. San Pedro Street, Los Angeles, Cal.

THE GREBE SYNCHROPHASE

TRADE MARK REG. U.S. PAT. OFF.

This company owns and operates stations WAHQ and WBOQ; also low-wave rebroadcasting stations, mobile WGMU, and marine WRMU.



"The Gods cannot help one who loses opportunities."

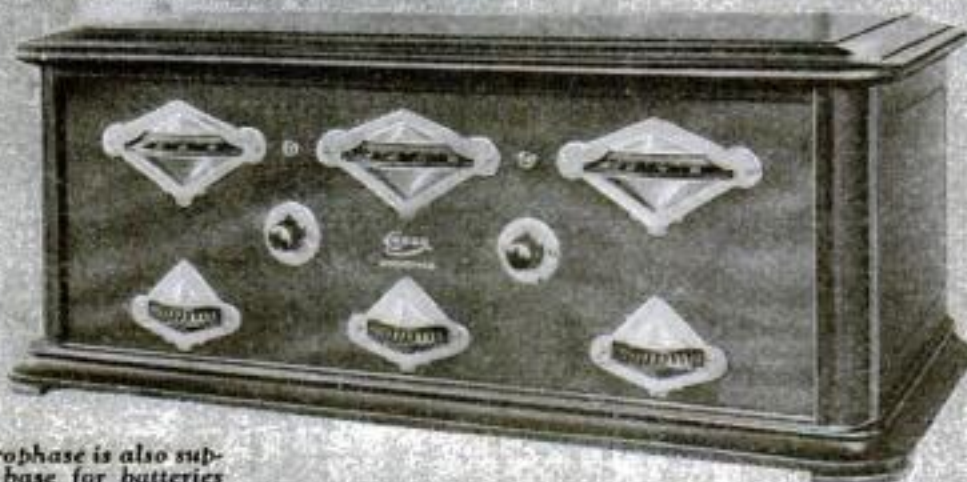
—Mencius

The wise man will provide against the future by securing a Synchronphase.

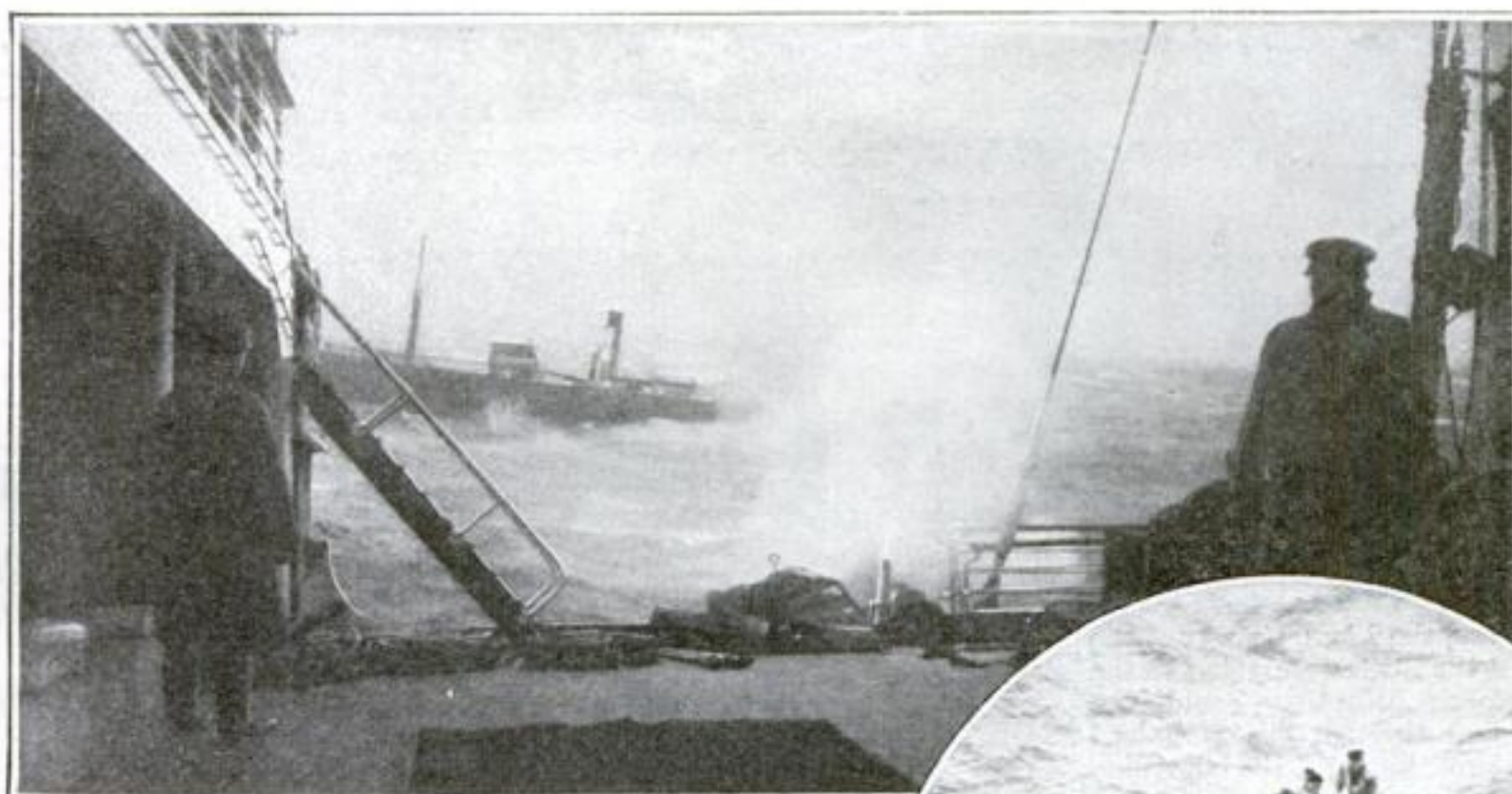
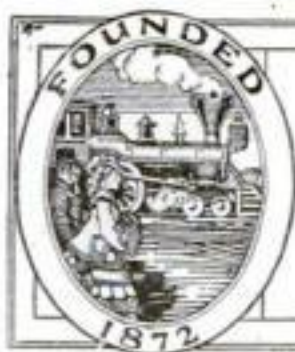
Doctor Mhu



All Grebe apparatus is covered by patents granted and pending.



The Synchronphase is also supplied with base for batteries and in a de luxe Console Model.



Shooting a line from a mortar on the deck of the *President Harding* to the sinking freighter *Ignazio Florio*, tossed and battered, at the mercy of mountainous waves. A remarkable photograph taken during the heroic rescue that was effected a few weeks ago, and that was made possible by wireless

How an *Invisible Lifeline* Rescues Men from the Sea

A Story of Heroism Made Possible by Wireless



Saved!

The doomed freighter's crew of 27 being carried to safety in the liner *President Harding's* lifeboat manned by hardy volunteers

WHEN the Italian freighter *Ignazio Florio* was pitched and tossed a few weeks ago in the mountainous waves and cavernous depths of the worst storm an angry Atlantic has concocted in many years, it was an invisible lifeline that held out hope to her badly battered crew. That line was composed of the dots and dashes of Morse code sent by wireless.

A tempest in mid-Atlantic would well be a match for the iron boxes that sail the seas but for that invisible lifeline. Gales that sweep like cyclones, waves that coil and strike like giant sledges, swirling waters that hiss ominously and churn and churn, still taunt and harass seamen—much as they ever did.

Ships still are swallowed by a hungry ocean. Even now restless waters are licking the iron bones of the Italian freighter. But, thanks to radio, and to the traditional courage and humanity of one seaman called to the aid of another, those bones are dry of their marrow of

By Peter Vischer

men. Twenty-seven men and a cat were saved from the canted deck of the *Ignazio Florio* by Capt. Paul C. Grening, of the United States liner *President Harding*. Only one man and a dog were lost, the one an officer swept from his bridge by a thunderous wave before the *President Harding* was called to rescue; the other, smashed against the side of the freighter as he tried to swim to his rescuers.

Thus is the ingenuity of man, as expressed in progressing science, succeeding in his struggles against what were once considered insuperable natural odds, acts of a displeased god. Thus is man inventing new life insurance for himself. But for the helping hand of science, storms would have taken a lamentable toll of life during the week the hapless *Ignazio Florio* foundered.

George Kohle, radio officer of the *President Harding*, was sitting in his cabin one night, phones on his ears,

cigarette alight. All at once he straightened up. His hands went to the phones and he listened sharply. A switch clicked home and generators began to whine. He had the *Florio's* SOS. Possibly you heard it on your own radio set. Certainly, if you live in the eastern part of the United States, broadcasting suddenly was stopped for you when the call of distress sounded.

KOHLE grabbed the speaking tube and shouted to his captain, who was gazing outward from a tossing bridge. He broadcast the SOS and got five answers out of infinity—from the *Lorain*, *Elven*, *Portland Maru*, *Invergoil*, and *Cadore*. Even then the *Harding* had changed her course, plunging directly into the vortex of the storm to go to the Italian's assistance.

Back and forth went messages of hope, pleas for quick help, promises of assistance, requests for directions and bearings, orders for lights and rockets.

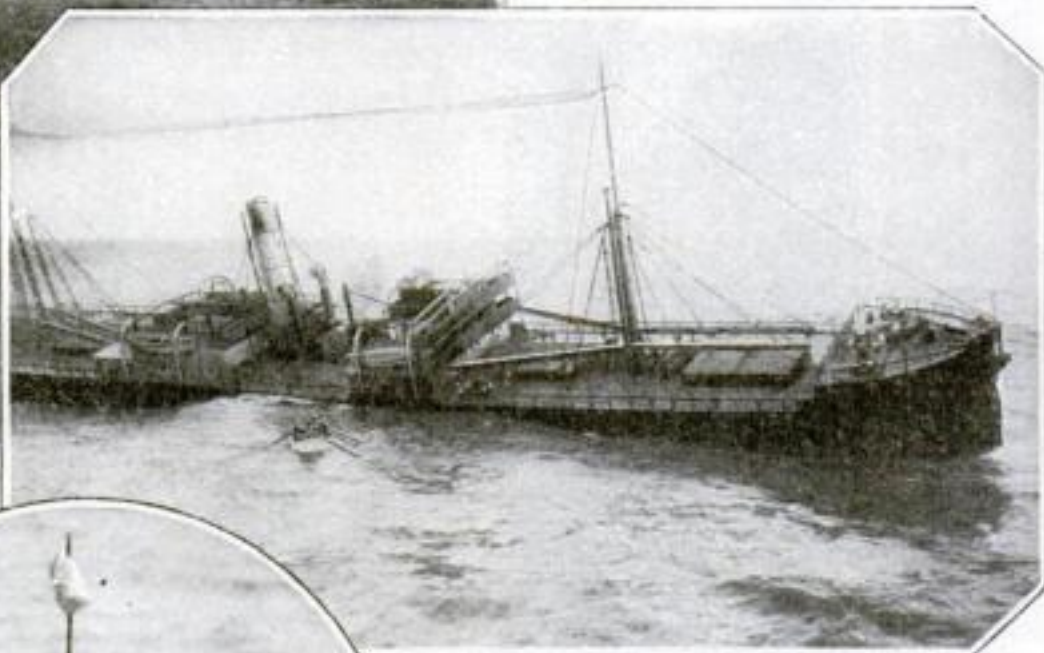


A Spectacular Rescue

At the left: Coastguardsmen shooting a rocket line to the sinking trawler *Imperial Prince*, stranded recently off the Scotch coast near Aberdeen. Two of the trawler's crew perished in the heavy sea. The rest were rescued.

The Critical Moment

Below: The *President Harding's* lifeboat approaching the side of the foundered *Ignazio Florio*, where the exhausted crew may be seen in a huddled group waiting to be taken off.



The *Harding* and the *Elven*, nearest of the six who heard the SOS, were going to the *Ignazio Florio* as best they could, the *Elven* stumbling through the turbulent waters at two knots; the *Harding* managing to make six.

Even then the Italian freighter was doomed. A mountainous wave had smashed in a forward hatch and water was flowing into her bowels. Water was flowing to a thirsty cargo, a cargo of grain. The rudder was broken. One of the booms was off. The lifeboats were smashed.

"THAT Captain Grening, he is very great humanity," said Capt. Aniello Lauro, master of the freighter, when he arrived in New York, "for we were in very bad way. We were in very terrible weather with a very terrible cargo. Grain, grain is so very bad. When you ship water you had better have wild horses on board than grain. Grain drinks and drinks—and then—"

Yes, the freighter was doomed. But her men were not. For 50 hours Angelo Trombino sloshed about in an engine room that was a death trap, administering to dynamos and pumps. For the same 50 hours Luigi D'Ambrogi sat in a wireless shack and tapped. And listened. While these two, trained in the uses of science, carried on, there was yet hope.

Finally, after a night and a day of buffeting, the *President Harding* sighted the freighter. She reeled 'round and 'round the foundering box. The seas fought to keep them apart; but slowly, slowly, the *President Harding* drew close.

The next afternoon Captain Grening got out the Lyle gun—a mortar from which a projectile with an attached line is shot. The *Harding* was to windward and oil was poured on the waters to lay the waves. The gun was fired once, twice, thrice, before the line went to the freighter. A lifeboat was floated on the line, but there was no getting into such a comet. Hemp lines were sent over, but they parted. Only the radio line was flexible enough to hold.

At intervals through the night, Captain Grening played his searchlight on the unhappy freighter and realized the craft was nearing her end. He made up his



Through the Storm on a Raft

Lashing themselves to a small improvised raft, these six sailors of the wrecked schooner *Hattie* recently rode safely through a six-hour hurricane, and drifted for five days without food or water. When finally picked up by the liner *Southern Cross*, all were on the verge of collapse. One of the survivors is holding a pole with handkerchief attached, with which they attracted attention of the liner. The *Hattie* went down in a seething sea off Cape Hatteras, on the coast of North Carolina.

mind that the moment she started down he would drive for her, run his ship bow to her bow, and drop overboard anything that would float—rafts, life preservers, planks. He meant to save lives if it were humanly possible.

SUCH a desperate effort was saved by a curious lull in the storm, a softening in the waves for two hours of the early morning, during which Captain Grening sent over a big Lundy lifeboat manned by volunteers. Every man on the *Harding* wanted to go. And then Captain Grening made this entry in his log:

"Detention 21 hr. 15 min., rescuing crew of S. S. *Ignazio Florio*. Overcast, whole gale, very high sea."

It is within the very recent memory of man that the wireless was first used at sea. The first message was sent from the American liner *St. Paul* to the *Needles* on Nov. 15, 1899, as the former was completing her fifty-second voyage across the Atlantic.

To laymen, the success of wireless

telegraphy on the high seas was only assured in 1909, when Jack Binns sent out a call for assistance from the White Star liner *Republic* after her collision with the Italian Lloyds steamship *Florida* off Nantucket. That happened January 23, 1909.

The *Republic* had on board 700 pleasure-seeking Americans bound for a winter cruise in the Mediterranean, when she collided with the *Florida*, carrying 900 immigrants and a crew of 200. From the wreckage of a Marconi room, Binns, cold and drenched and hungry, kept sending out what was then the call of a crippled boat for help:

"C Q D, C Q D, C Q D."

THE quick response to that call was all that saved hundreds of lives.

Two months after the *Republic* collision, the steamer *Horatio Hall* was aided in distress in almost the same position. Four other times that same year wireless summoned aid to foundered ships, among them the steamer *Ohio*, from which 150 passengers were rescued off the Alaskan coast. Not a month—hardly a week—has passed since then without some incident of the same kind.

Without wireless, the *Titanic*, which struck an iceberg on her maiden voyage and sank in mid-Atlantic with enormous loss of life, would have dropped from sight to become one of the world's many maritime mysteries.

More than a thousand American seamen have gone to watery graves in a score of vessels that have disappeared from the face of the earth without a trace. Some of these, curiously, disappeared during this present century, in spite of the safety to be found in modern means of communication.

These, however, are the exceptions that prove the rule that today we know. The developments of science have made it possible for the seas to be made as safe as land; and, if you'll believe many an old salt, much safer.

Flaps Its Wings like a Bird

Amazing Autogiro Can Land Almost Vertically



The Successful Test Flight

Left: The autogiro, piloted by Capt. Frank Courtney, taking off for its successful test flight at Farnborough, England. By means of its flapping windmill-like wings it rose swiftly, flew nearly 50 miles, then returning to its starting place, dropped almost vertically. Below: Diagram showing constructional details of the remarkable machine. Note the huge lifting screw driven by the wind and turning at from 120 to 140 revolutions a minute

By Arthur A. Stuart

AT FARNBOROUGH, England, a few weeks ago, a group of aeronautical engineers and aviation enthusiasts assembled to witness an event that may revolutionize completely the future development of the art of aviation. An odd, awkward looking flying machine, topped with a windmill arrangement that flapped like the wings of a bird, rose swiftly from the ground, accomplished a trial flight of almost 50 miles, and then returned to its starting place, dropping almost vertically and coming to a full stop within 20 feet of the place where it first touched the ground.

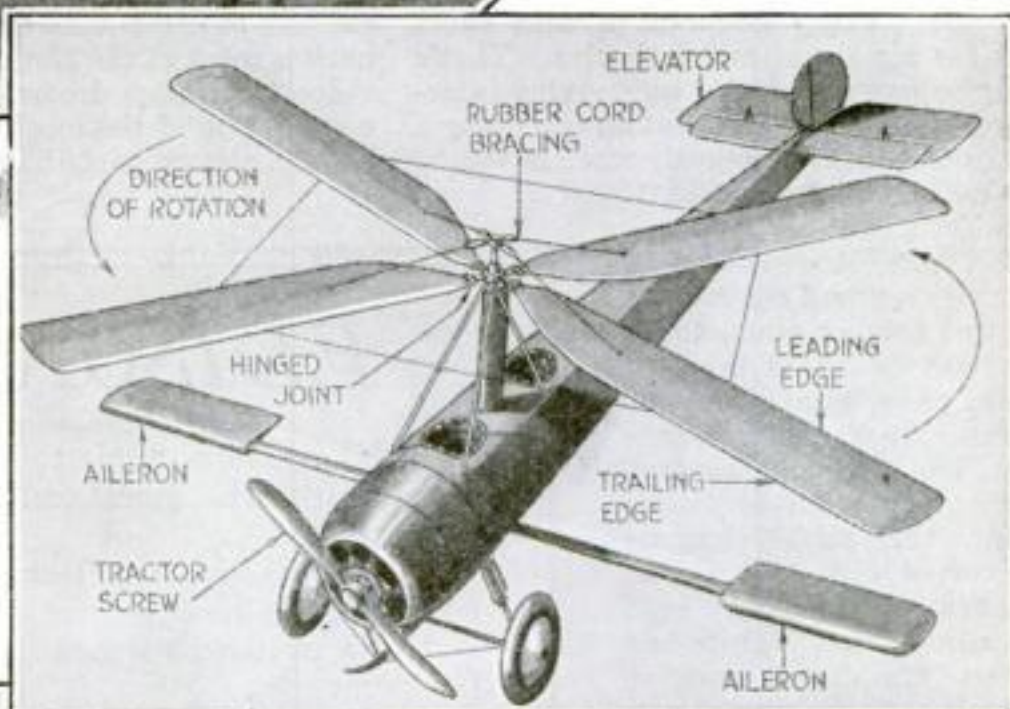
This queer machine, which conforms to none of the usual rules for airplane design, is called the "autogiro." It is the invention of Don Juan de la Cierva, a young Spanish engineer, who has brought it to its present stage of development after five years' work.

Vice Marshal Sir Sefton Brancker, of the British Air Force, after witnessing the successful demonstration of the machine, declared that "it is the greatest step in aeronautical progress since the Wright brothers flew the first airplane."

That de la Cierva was working on a revolutionary type of aircraft has been no secret. Several articles describing various stages of his progress have appeared in POPULAR SCIENCE MONTHLY. The aviation world, however, scarcely was prepared for the sensational success of this public demonstration.

WHEN Capt. Frank Courtney climbed into the fuselage, the tractor air screw was set whirling, the huge blades flapped, and within 300 feet—about one-third the distance required by the ordinary airplane—it had left the ground and was sailing gradually out of sight. Then at the end of the trip came the most remarkable part of the demonstration.

When only a few hundred feet above the ground the pilot shut off his engine. The tractor screw slowed up and ceased to revolve, and the machine floated down



Hovering, with Engine Dead

Nearing the ground, the pilot shut off his engine, and the machine floated down almost vertically, landing with a run of 20 feet

almost vertically, landing without damage with a run of less than 20 feet. Here, at last, was an airplane that could land on a mere spot; the airplane possibly that may point the way to planes that can land on the roofs of houses or in city streets and parks and thus enlarge amazingly the utility and scope of aircraft.

The machine starts off in the ordinary way by aid of an engine-driven tractor screw. To start the lifting blades rotating, men haul away a steel cable wound round the base of the screw, much as a string is pulled from a top. According to measurements, the autogiro leaves the ground with the low speed of 15 miles an hour. Its maximum speed in the air is 70 miles an hour.

IN ORDER to stay in the air, an ordinary airplane must keep up high velocity. Even a small loss in velocity may result in an accident. It is claimed that the autogiro is very slightly affected by loss of forward speed, the real speed which counts for sustentation being that of the wing tips, which travel over a spiral path at a much higher velocity than the speed of travel.

Even if the engine should fail completely, the blades of the autogiro will sustain the plane in the air, allowing it to sink slowly and land safely.

Inventions that Edison Still Hopes to Make

Nearly 80, he now works only 18 hours a day because he has to sleep more—
But even so, he may give us an automobile battery to last 10 years,
and other marvels to make life pleasanter—His remarkable fore-
casts of future progress—A fascinating, intimate picture
of America's grand old man of applied science

By John R. McMahon

EDISON in his seventy-ninth year is running short of time—has to sleep so much now that his working day is limited to a pitiful 16 or 18 hours. He needs every moment of that short day for his important activities. That's why he has practically quit giving interviews and why he felt that he was doing a considerable favor recently when he talked to me awhile for *POPULAR SCIENCE MONTHLY*.

I used to interview America's grand old man of applied science when three or four hours of nightly sleep gave him a bit of leisure. He was then crusading, as it were, against humanity's vicious sleep habit. He almost had us converted when Nature put the brakes on his very self. He admits that Nature has licked him into wasteful snoozing. You cannot say that he has the sleeping sickness, yet his daily working time is now only about twice that of the average man. He works only two days in one, instead of almost three, as when he was in his prime.

IMPORTANT as Edison's work is, you feel the man is more important. Might be better if he were made to knock off all work for the rest of his life and just talked to the American people on how to do it. This father of half the marvels of civilization should just scold us and cheer us and advise us what to eat for breakfast.

You go away from his Orange, N. J., laboratory in a daze, feeling that you have talked with Moses, Columbus, and Darwin in one. He is the most historical character in the world today. Legends are forming about him. A barrel of haloes are ready to put on his brow. I am glad there is also plenty of homely stuff, some of which I'll give you, about Tom Edison, the pal and crony of his men in the experimental shop.

Every one knows what he looks like—at

least that domelike forehead, now thatched as Pike's Peak in winter. Ruddy complexion, gray eyes that often stare and dream. A chunky middle-height figure, careless of dress, who trots about spryly, hatless most of the time. A high pitched voice that may drone or become a bit nasal. One of the most human of men—boyish, slangy in offhand talk, and, like

yours and mine—the whole world's.

It is said a traveler asked an Eskimo and then a South Sea Islander who was President of the United States. Both replied "Edison." When the same question was put to the king of an African tribe, his majesty hesitated between Edison of the talking box and a comedian of the pictures that move. A discarded incandescent bulb

was put on a heathen altar by a native priest and maybe it helped to illuminate the mind of the tribal god.

"Which of your inventions are your favorites?" was the first question I put to Edison.

"Phonograph, moving pictures," he replied. One may note his economy of language in leaving out "and."

THE answer reminds us of a fact of which many are unaware, that the inventor did pioneer work in moving pictures. This was during a period from 1887 onward to the late 90's, when the world did not dream that pictures could follow action.

"Why do you prefer the phonograph and the pictures, Mr. Edison?"

"I like the phonograph because I love music, and there are great possibilities. The motion pictures are my only theatrical diversion on account of my extreme deafness."

The inventor of the phonograph not only loves music, but selects the artists

and the compositions for the records of his machine. He used to have a flock of prima donnas in his laboratory, trilling and warbling under his personal direction. Seems to me like the high C of versatility for the same man to invent, manufacture, and then act as bandmaster for his recording songbirds. As for his "extreme deafness," that is a small and casual handicap; he has been more or less deaf for many years. Beethoven was deaf most of his life.

EDISON says—

"**T**HERE is no limit to the invention of fully automatic machines. Man will work less and less."

"The sun engine will come when the price of combustibles greatly increases."

"It is possible to make a concrete house in a few hours."

"The world doesn't need more inventions just now, until general intelligence has increased so men can be had to operate what we have."

"What new lines of research am I engaged in? Many. Wait until I've caught the fish."

"My favorite inventions—phonograph, moving pictures. I like the phonograph because I love music. The motion pictures are my only theatrical diversion on account of my extreme deafness."

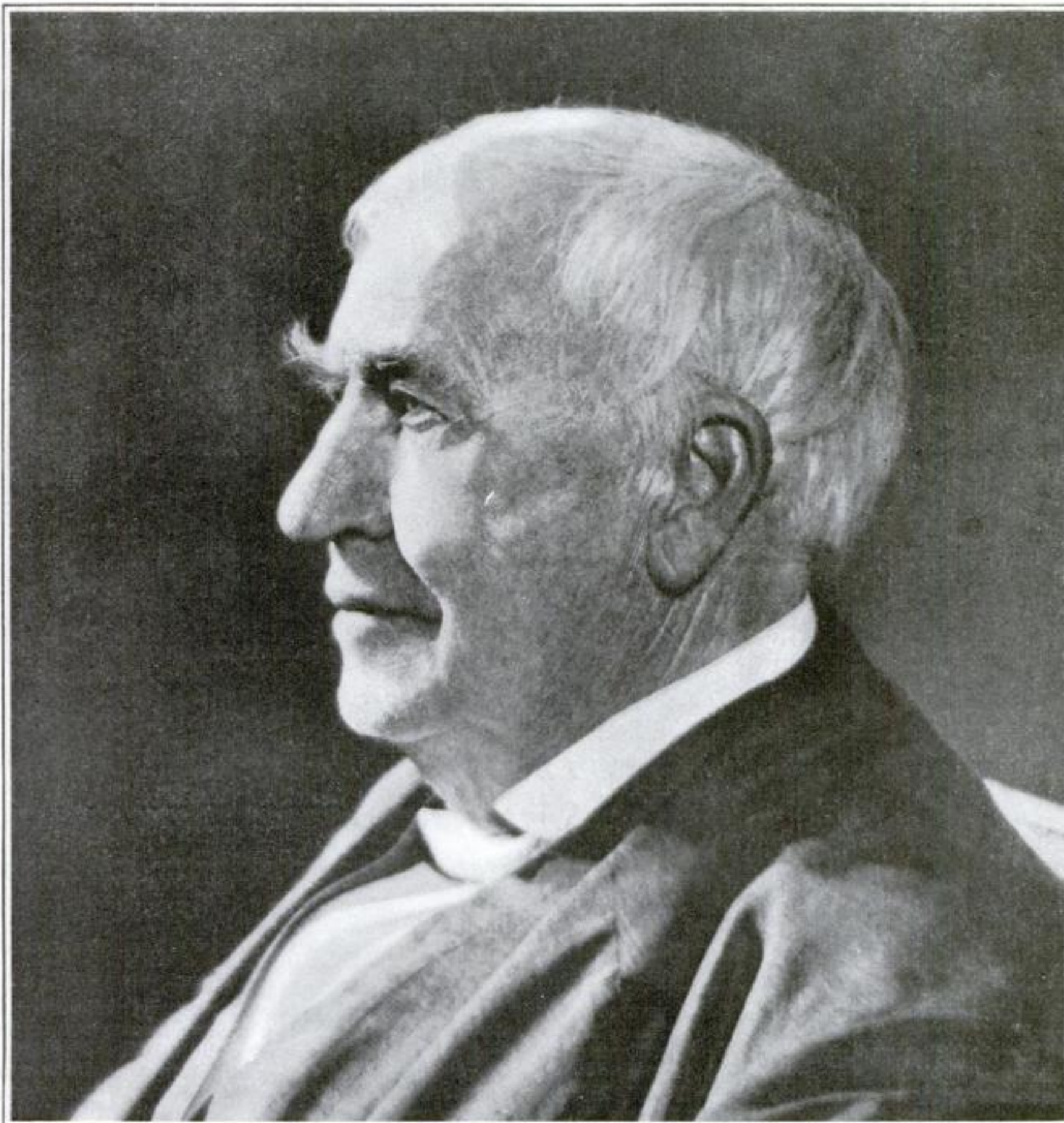
"I now sleep from five to six hours. The quality is still perfect."

"I eat very little. The amount of power one can get out of a piece of toast is marvelous."

"The number of men in every nation, per capita, who are honest, humane, and intelligent is increasing. This number is a measure of our civilization. The Lord appears to be in no hurry."

most great men, always unconscious of self.

After patenting more than 1000 inventions, of which several are major contributions to human progress, has Edison another miracle or two up his sleeve? I asked him that and you'll see he dodged the answer. My bet is in the affirmative. Assume such a man and such a record, still able to work two days in one, he can't help adding another ornament or so to the monument of his achievement. And that ornament will be our gain—



"One of the Most Human of Men"—Thomas A. Edison as He Is Today

A chunky, middle-height figure, careless of dress, who trots about spryly, hatless most of the time. A domelike forehead, now thatched as Pike's Peak in winter, ruddy complexion, gray

eyes that often stare and dream. A high pitched voice that may drone or become a bit nasal. Boyish, slangy in offhand talk, always unconscious of self. That is the great Edison at 79

"What about that sun engine?" I asked, referring to his old project of getting energy direct from the sun's rays. He had a model, I believe, to which Sol contributed a fraction of the potential billions of horsepower.

"It will come when the price of combustibles greatly increases."

A humorist may comment that, thanks to the coal strike, the sun engine is now due. Without question, such a machine is practicable in desert or cloudless areas. Something of the sort has been reported in use in Egypt. Last summer an egg was cooked by sun heat on a Washington pavement, according to report. Let's

laugh now; posterity will laugh at us.

"And your poured house, Mr. Edison?" I asked. "Isn't this now practical commercially by use of the new bauxite cement that hardens in 24 hours?"

"It is possible to pour a house in a few hours," was the reply. "The commercial man of vision has not yet come forward. Portland cement is all right, as it can be made 'quick set.'"

It may be explained that for this scheme the inventor has set up the mold of a complete house in cast iron plates, smoothly machined and bolted together. There was reinforcement within the mold. Liquid concrete was to be poured in at

the top, making the house in one operation. At the time of the house project, Edison told me it was his pet; he hoped it would be his special gift to working people who wanted a substantial home; he was not going to accept a penny for that invention. Let's take the will for the deed, and hope that "the commercial man of vision" will yet get busy on this housing stunt. In the laboratory yard I saw a sample of house ornament in cement that has been weathering for years and looks like new.

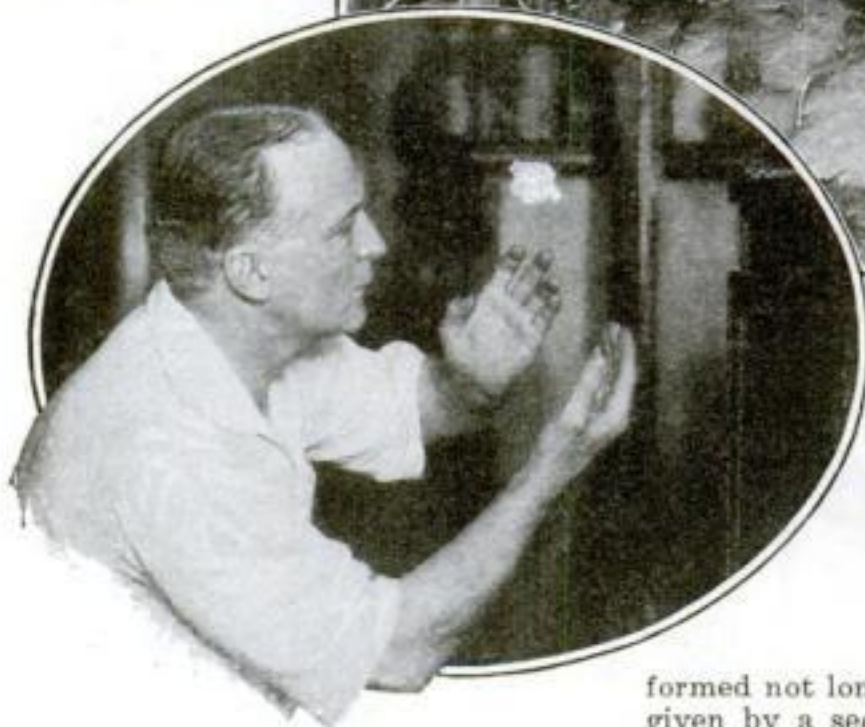
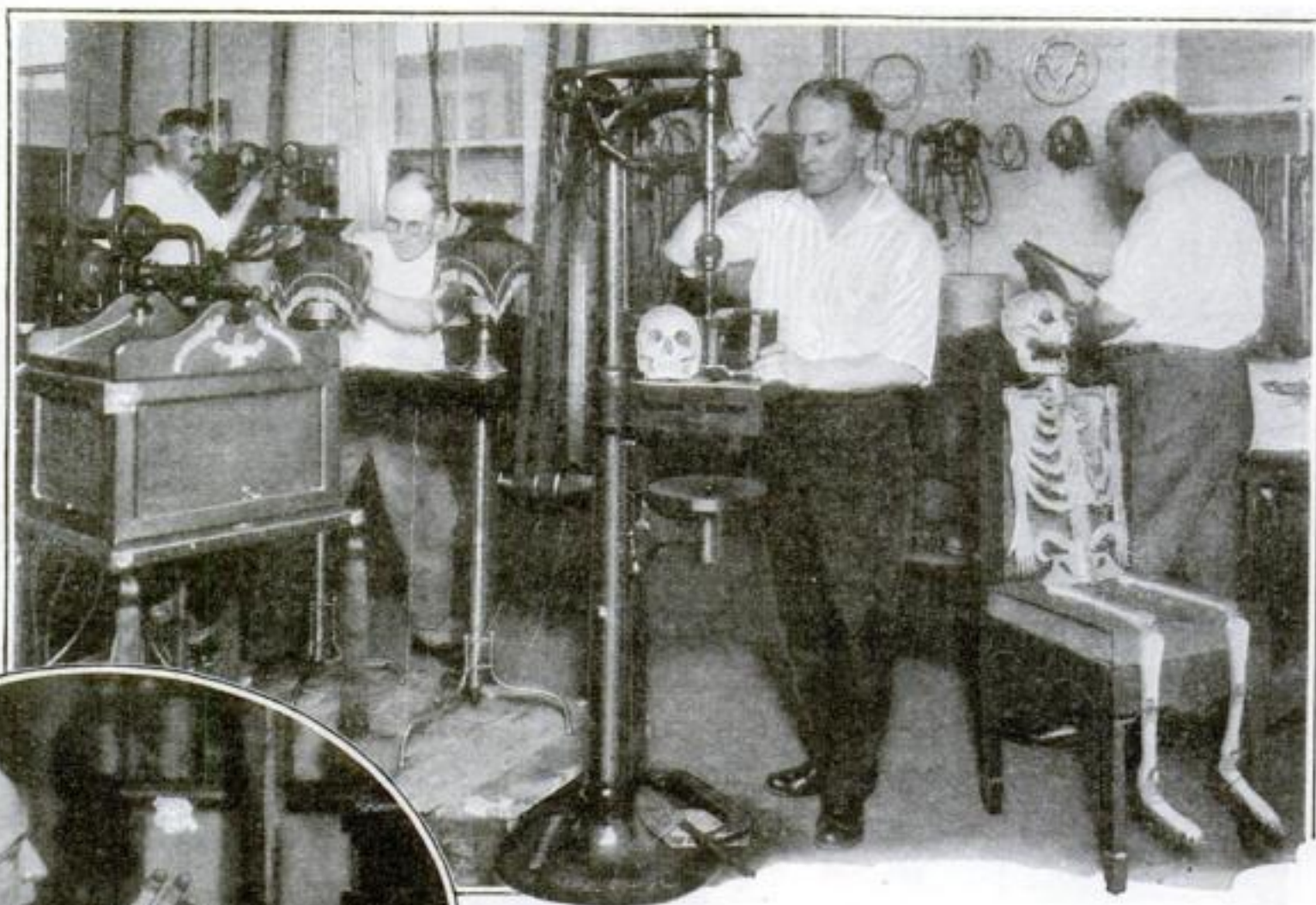
"Has the alkaline storage battery been further perfected?"

(Continued on page 132)

Lessons in Magic—By Houdini

In Houdini's Laboratory

The photograph at the right shows Houdini and his assistants in the magician's New Jersey laboratory making the complicated and expensive apparatus used in his stage work. Effective magical tricks, however, can be performed with no special apparatus, as Houdini demonstrates in the accompanying article. One of these, a magic paper trick explained on page 17, Houdini is performing in the picture just below.



The King of Magicians Explains Simple, Mystifying Tricks that Any Amateur Can Perform at Home

IN THE course of my discussion of the tricks of fraudulent spiritualistic mediums in the last two numbers of POPULAR SCIENCE MONTHLY, I mentioned several times the legitimate trickery that professional magicians use to entertain and amuse. In this article I am going to tell you something definite about that kind of trickery. In fact, I am going to give you a lesson in magic—teach you how to do some most effective tricks with which you can mystify your friends.

The tricks I have selected are simple and require no apparatus beyond common objects that you will find at hand almost anywhere. You can learn the *method* of performing any one of them in a few minutes, and, even if you never have previously attempted to be an amateur magician, you ought to be able to acquire the dexterity necessary to perform them perfectly by a little practice. Simple though they be, however, they are real professional tricks that I myself use or have used on the stage, or that have been used by some of the most famous conjurers that the world has known.

Possibly as good a way as any of illustrating how a trick most simple in detail can mystify and bewilder even an exceptionally intelligent and wide-awake audience, is to describe a trick that I per-

formed not long ago at an entertainment given by a secret order in a hall in the upper part of New York City.

I borrowed three handkerchiefs from the audience, had them marked for identification, knotted them together, and placed them under an opaque glass bell on a table. Then I informed the audience that I would undertake to transport the handkerchiefs magically from beneath the bell to any place that might be selected within 15 miles of the stage. The place was to be chosen by vote, so I distributed slips of paper on which the members of the audience might write their wishes. The slips were collected, placed in a hat and brought to me on the stage. I dumped the votes on a plate, picked up three of them and had a little girl select one of these. When this was unfolded by a gentleman from the audience, he read:

"UNDER the top step of the Statue of Liberty."

Immediately a titter went through the audience. The Statue of Liberty, as you probably know, stands on a little island in New York Harbor, 10 or a dozen miles away from the hall in which I was performing. That I should claim that by waving my wand I could cause those three handkerchiefs to be wafted invisibly over the city and bay and to be carried up the narrow winding stairway

in the interior of the statue seemed highly ridiculous.

I acknowledged the laughter; then I requested the audience to select a committee of men unknown to me and of such character and standing that they could not be bribed or otherwise persuaded to aid me in deception. With this committee I left the hall, rode in the Subway to the Battery, and took the steamboat to Bedloe's Island, where the statue stands. The committee mounted the stairway and under the top step found a locked metal box. With this we returned to the hall, where the persons attending the entertainment were by that time sitting at a banquet.

IT WAS necessary to call in a locksmith to open the box, and inside it was found another box of tin, sealed with solder. When the second box was opened there were the three handkerchiefs!

Now you may suspect that I myself carried the handkerchiefs to the statue, hiding them from the committee which accompanied me and placing them in the boxes by some feat of conjuring. I assure you, though, that I never touched the handkerchiefs from the time the audience saw me with them on the stage until the locksmith opened the boxes in the banquet hall. This is the way the trick was done:

Under my waistcoat I had three other

handkerchiefs, knotted together just as I knotted the handkerchiefs obtained from the audience. I made a "switch," taking the prepared handkerchiefs from beneath my vest and substituting the handkerchiefs I had borrowed. Then I placed my own handkerchiefs under the glass bell. In doing so, I contrived to drop the bell to the stage and break it—a piece of pretended carelessness which I had previously rehearsed.

ACTING as though chagrined by the "accident," I called to my assistant to hand me another glass cover, and, as I met him at the wings to take it from him, he deftly took the handkerchiefs from beneath my waistcoat, hurried out of the hall, took the subway to the Battery and caught the boat for Bedloe's Island. On the island, another assistant and a tinsmith were waiting for him. The boxes were hastily prepared and placed on the statue stairs, where they were waiting for the committee.

The Statue of Liberty boats operate on a definite schedule, so it was easy for me to time the performance of the trick so that my assistant would catch one boat and the committee and I a later one, giving my confederates ample time in which to box the handkerchiefs.

The choice of the statue, of course, was made by me and not by the audience. Concealed in my hand, I had three slips of paper on each of which I previously had written a "vote" for this place. When I dumped the votes of the audience from the hat, I placed these three slips on top of the pile, then picked them up again and offered them to the little girl.

This is a trick that is quite within the capabilities of an amateur performer. In these days of motor cars, you might even permit your audience actually to choose the place to which the handkerchiefs are to be transported; then, when the choice is announced, have your confederate dash off in a car and leave the handkerchiefs at the spot designated.

As a preparation for the trick, roll a cigarette paper into the smallest ball you can and conceal it in the fold of skin between the thumb and first finger of the right hand. I have indicated the position of the pellet in the accompanying photograph, although the thumb and forefinger, of course, must be held closer together for purposes of concealment when you are actually performing the trick. Then take a cigarette paper and tear it into four or five strips. Roll these strips between the finger tips into a little ball. Work this down between the palms and continue rolling as though desiring to compress the paper still further.

This will give you an opportunity to remove the prepared ball from between the thumb and forefinger to the palm of the right hand, while you slip the torn ball into the fold between the thumb and forefinger of the left hand or between the tips of the thumb and forefinger of the right hand where it will be concealed by the untorn paper. A little practice

will enable you to do this swiftly and invisibly to your audience.

Take your prepared ball and slowly unroll it. When it is smoothed out as much as possible, let it flutter to the floor. The eyes of your audience will be drawn irresistibly to the falling paper, and this will give you an opportunity to get rid of the ball of strips by some natural movement that will not be detected.

THERE are several other ways of performing this trick. The method I have given though, is possibly the simplest, and hence the one best suited to a person who is not an experienced magician.

Here is a simple trick that is bound to provoke amazement and wonder: You take a piece of paper, half a sheet of newspaper, say, roll it into a ball in front of your face, then take your hands away—and the ball remains suspended in the air! Not only that, but it will obey your commands to rise or fall!

The secret of this trick lies in having a long hair suspended from your ear or temple with magician's wax. There is also a tiny bit of wax at the other end of the hair. You affix this latter piece of wax to the wall or to the side of a bookcase or some other article of furniture, a thing you can do easily without arousing suspicion. Then you roll up the paper around the hair, and, when you take away your hands, it remains apparently floating in the air. By moving your head slightly forward or backward, you can cause the ball to go up or down at your order.

A simple trick that can be performed successfully virtually without practice, yet one that will mystify almost any audience, is known to magicians as the "One-Ahead Envelope Trick."

You distribute envelopes and sheets of paper among your audience, requesting each person to write a question on the paper and seal it in the envelope. Then you collect the envelopes, hold them one by one against your forehead and read and answer each question apparently without opening the envelopes.

THE simplest way of performing this trick is with the aid of a confederate in your audience. When you have collected the envelopes, pick up the top one, hold it to your forehead, and, after appearing to concentrate for a moment, ask any question that hap-



Houdini Shows
How a Perfect
"Spirit Glove"
Can Be Made

HERE is a trick, not so complicated though probably more difficult in that it requires not a little dexterity, skill, and "patter," or small talk, to "put it across" properly. It is a trick that many famed magicians have used successfully. You tear up a cigarette paper, roll it into a small ball, then open the ball and show the paper untorn and undamaged except for a few wrinkles.

SPIRITUALISTS say only a disembodied spirit can make a paraffin hand; that a human hand cannot be withdrawn from a mold of paraffin because the wrist is so much smaller than the wide part of the hand. Houdini shows here how a perfect "glove" of paraffin can be made. The hand is greased, then alternately dipped into the cold water in the jar at the center and molten paraffin in the can at the right, until the desired thickness of paraffin is obtained. With the index finger the edge around the wrist is gradually loosened, and the hand is thrust into the water to permit the water to trickle between

the hand and the paraffin. Then the hand is thrust into the can of warm water at the right. This softens the paraffin sufficiently to permit the withdrawal of the hand. With the paraffin kept soft with warm water, the wrist of the glove is manipulated to the correct size and shape. Molds of hands in virtually any position can be made by this method—even two hands clasped. This is Houdini's first exposé of this spiritualistic trick, which is interesting not only to investigators of psychic phenomena, but also to sculptors and others who might find use for a method of making perfect reproductions of the human hand

pens to pop into your mind. Your confederate will acknowledge this question as his. You answer it; then you open the envelope, as though to check the accuracy of your reading, and read the question written on the sheet you find within.

Holding a second envelope to your forehead, you repeat aloud the question that was contained in the first envelope. The person who wrote it, of course, will acknowledge it; you give your answer, and, under pretext of satisfying yourself as to the correctness of this reading, you open the envelope as before, thereby learning what the next question is. You proceed in this way until you have answered all the questions. It will be necessary for you, of course, to reach the envelope containing your confederate's question last of all.

YOU can also perform this trick without a confederate. When the envelopes have been collected, pick one up at random, hold it to your forehead, and, pretending to read the contents, say, "Why does Lillian love me?" or something equally unlikely to be acknowledged by its supposed writer.

When you get no response, pretend to be displeased, and say, "Well, if you won't acknowledge your questions, I can't very well proceed with the test. I'll try one more, though." Then open the envelope and repeat its contents as you hold the next envelope to your forehead. In this case it will be necessary for you to have in the pile one envelope more than the number actually collected from your audience. Otherwise you're likely to be embarrassed by finding that you've answered all but one of the questions and have no envelope with which to proceed with the trick.

There are many other versions of this trick. The key lies in discovering the contents of the first envelope. Your own ingenuity may suggest other methods than those I've mentioned. As a hint: Alcohol will make even the best grade of paper almost as transparent as glass, and it evaporates so rapidly that its use is not likely to be detected by ordinary audiences.

HERE'S another simple but "showy" and effective trick. Take four or five packages of paper clippings, each of a different color, say red, green, yellow, blue, and white. Open them and place them in a glass bowl or jar that is large enough to receive your entire hand. Ask some one in your audience to mix the paper thoroughly. Then when the different colors are mingled virtually beyond hope of separation, ask the mixer to plunge his hand into the jar and draw out a handful of blue paper only. He will hesitate and look at you in bewilderment.

"What!" you say to him. "You can't do it? Here, let me show you." Then thrust your hand into the bowl and draw out a handful of the color you have mentioned.

Then say, "Well, now that I've shown you how it's done, you ought to be able to take out a handful of red. What, you can't? Look!" And proceed to plunge your hand into the jar again, this time drawing out red paper only. Repeat the



The Cigarette Paper Tear

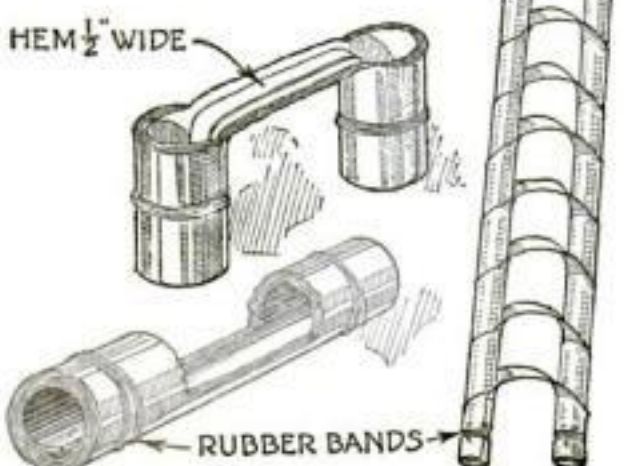
This highly mystifying trick consists of tearing a cigarette paper into strips, rolling it into a little ball, and then unfolding it to show it uninjured. The secret lies in having another paper rolled into a pellet and concealed at the root of the thumb, as shown in the larger picture. When the other paper is torn, it is rolled into a ball and hidden between the tips of the thumb and forefinger, as shown in the upper picture, while the prepared paper is unrolled. The audience, of course, is not aware that two pieces of paper are used.

test until you have demonstrated conclusively your ability to draw out any of the five colors at will.

The trick in this case lies in having little packages of paper of each color hidden under your vest, or in little pockets sewn to your trousers. Each package is secured by a strip of tissue paper of the same color as the paper it binds. When a certain color is called for, get hold of the proper package, place your hand in the bowl, and, with your movements screened by the paper in the bowl, work your

The "Jacob's Ladder"

A favorite paper-tearing trick. Fold a half-inch "hem" at top of a sheet of newspaper. Roll this and 10 or 12 other sheets, one after the other, into a cylinder about an inch and a half in diameter. Flatten cylinder and tear as shown in lower picture. Slip rubber bands about the ends. Turn them down and flatten the center part; then take the hem and draw out the ladder to its full length, with the result shown.



fingers until you've broken the tissue paper seal. Then take out your hand, and, moving your fingers so as to separate and crush the bits of paper, let the clippings flutter down.

I have found that simple tricks performed with household utensils and similar objects are much more effective for an impromptu display of magic than are more complicated illusions, requiring apparatus that the performer "just happened to bring along." Even if your apparatus is nothing more than an ordinary pack of cards, the fact that it is yours will arouse the suspicions of your audience, whereas you can "get away with murder," as the saying is, in performing tricks with articles that you pick up apparently at random.

A GOOD example of such a trick can be performed with a table knife and six bits of paper. The pieces of paper, which are carefully torn so as to be exactly the same size and shape, you moisten and affix to the knife blade, three on a side, those on one side corresponding in position exactly with those on the other. Explain to your audience that each little piece of paper is so fond of the corresponding piece on the opposite side of the blade that, if you were to remove one, the other would go away.

Illustrating this, you remove one piece, roll it into a little ball and throw it away. And, sure enough, when you show both sides of the knife, each contains only two pieces. Removing another, you show there is now only one on a side, and, when you take away the last one, both sides of the blade are found to be empty.

Pause a moment. Then look at the knife in surprise, and say, "Hello! I just heard three little taps. Sounds as if some of the papers were back!" You raise the knife, turn it about, and there are three papers on one side and none on the other. You hold the side containing the papers uppermost.

"Well," you say, "if those three are back, their partners will soon be here. Ah, here they are!" And you turn the knife over, showing three papers on each side as at the beginning.

TURN the knife over several times, then stop as if listening for a moment, and say, "Well, those three that just came back have decided not to stay with us after all. There they go." And, when you turn the knife about again, one side is found to contain three papers, while the other is empty. Pass the knife around, and let your audience see that three papers only are on the blade.

The secret of this trick is a simple sleight of hand through which you show the audience only one side of the knife while making them believe they are seeing both.

The knife is held close to the table at which you are sitting, with the point away from your body. The upper end of the handle rests on the middle joint of the forefinger, with the thumb on top. In this position only one side of the blade is visible. To show the other, raise the point of the knife to your chin.

(Continued on page 140)

Is This the Face of Future Man?

Our Descendants Will Have Cramped Brains, Pinched Cheeks, Long Noses, Squinty Eyes, Says Noted Evolutionist

By Ernest Brennecke, Jr.

WILL the faces of our descendants—of our grandchildren's grandchildren—look anything like the rather queer illustration on this page?

Will men of the future have small, cramped brains; sparse hair; long, thin, and prominent noses; tiny, "precious" mouths; narrow, squinty eyes; and no jaws or cheek bones to speak of? Will they, in brief, resemble water-blooded, "esthetic," meagerly nourished morons?

The answer is an unqualified, disheartening affirmative, according to at least one competent authority; and we must pull ourselves together to see just how such startling and undoubtedly distasteful forecasts possibly can be sustained. Already, evidently, our facial architecture is beginning to depart from the powerful, virile characteristics of our hardy ancestors, and to assume the lackadaisical features of this "future face" of ours.

How so? Let us see:

Scientists since Darwin have agreed pretty generally that man has arrived at his present physical stage through a long process of development from lower and perhaps less perfect forms of life. But if evolution has thus been going on all through the past and up to the present moment, will it not continue into the future?

IF SO, then surely it is legitimate to inquire as to the direction in which we human beings will develop; and how rapidly we will do so. In particular, if we compare our present features with those of the Java ape-man of some 500,000 years ago, or even the mummified skull of Rameses II of ancient Egypt, and if we notice how much the face of, say, the present Prince of Wales differs from these—then indeed we may well ask what the physiognomy of our successors on this planet will look like a few thousand years from now.

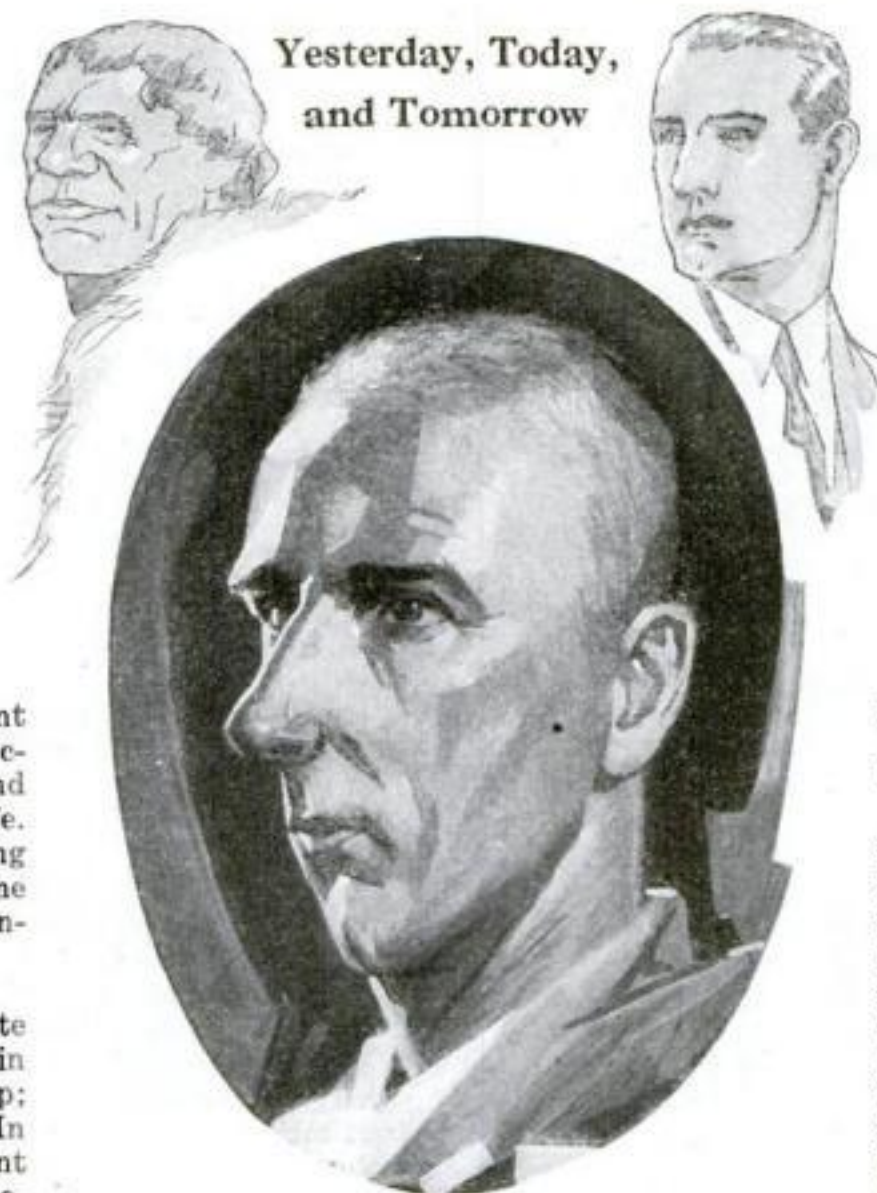
A sober and logical, if unpleasant visualization of our future face recently was proposed by the noted British biologist, Sir Arthur Keith, Fellow of the Royal Society, in an important discourse that he delivered before the Royal Institution on "The Rate of Man's Evolution."

Before arriving at his sensational estimates, Sir Arthur had examined and made records of hundreds of buried skulls of all ages (from the fragments supposed to date back to 500,000 B.C. to the present day), and also had measured carefully the heads and features of thousands of living persons.

His general conclusion: "Evolution

even now is rapidly at work on our faces," may be tabulated in detail as follows:

1. Man's brain capacity is growing steadily smaller. ("From the limited data at our disposal we must infer that the people who occupied western Europe at the close of the Ice Age [10,000 B.C.]



OUR artist has pictured here how the face of man may appear a few thousand years hence, based on predictions by Sir Arthur Keith. He also has drawn a striking comparison between the face of prehistoric man and that of present-day man, showing how the processes of evolution have tended away from the powerful, virile features of our hardy ancestors, toward the "soft" characteristics predicted for future man. Evolutionists point out that the rugged features of the caveman were born of the fierce primeval struggle for existence, and that with civilization these characteristics have been softened

stood distinctly above their successors of today in the matter of brain size. So far as concerns brain capacity of the skull there has been no increase.")

2. The roof of our civilized human mouth is becoming reduced in size and narrower.

3. Our jaws are receding.

4. Our nose is becoming sharper, narrower, and more prominent.

5. Our eyes are becoming narrower, and are sinking more deeply into the face.

6. Our cheek bones are becoming less prominent.

7. Our whole face is becoming narrower.

Now, if these processes go on according to Keith's schedule, the human head is destined gradually but certainly to assume the proportions indicated in the illustration.

Those who dispute this and maintain that modern man has ceased to evolve, said Sir Arthur, usually cite the similarity between the modern and ancient Egyptians to prove their contention. Only 10 years ago, he himself believed that the evidence from English excavations led to the same conclusion. But his opinion was altered by his most important investigations, carried out in recent years.

He took 50 skulls (25 of men and 25 of women) from English graves that were known to be 1000 years old or more; some of them were as ancient as the Pyramids. He carefully compared these ancient skulls with those of corresponding men and women who had lived in England in the eighteenth and nineteenth centuries. The result convinced him that the changes noted above actually have taken place—actually are taking place.

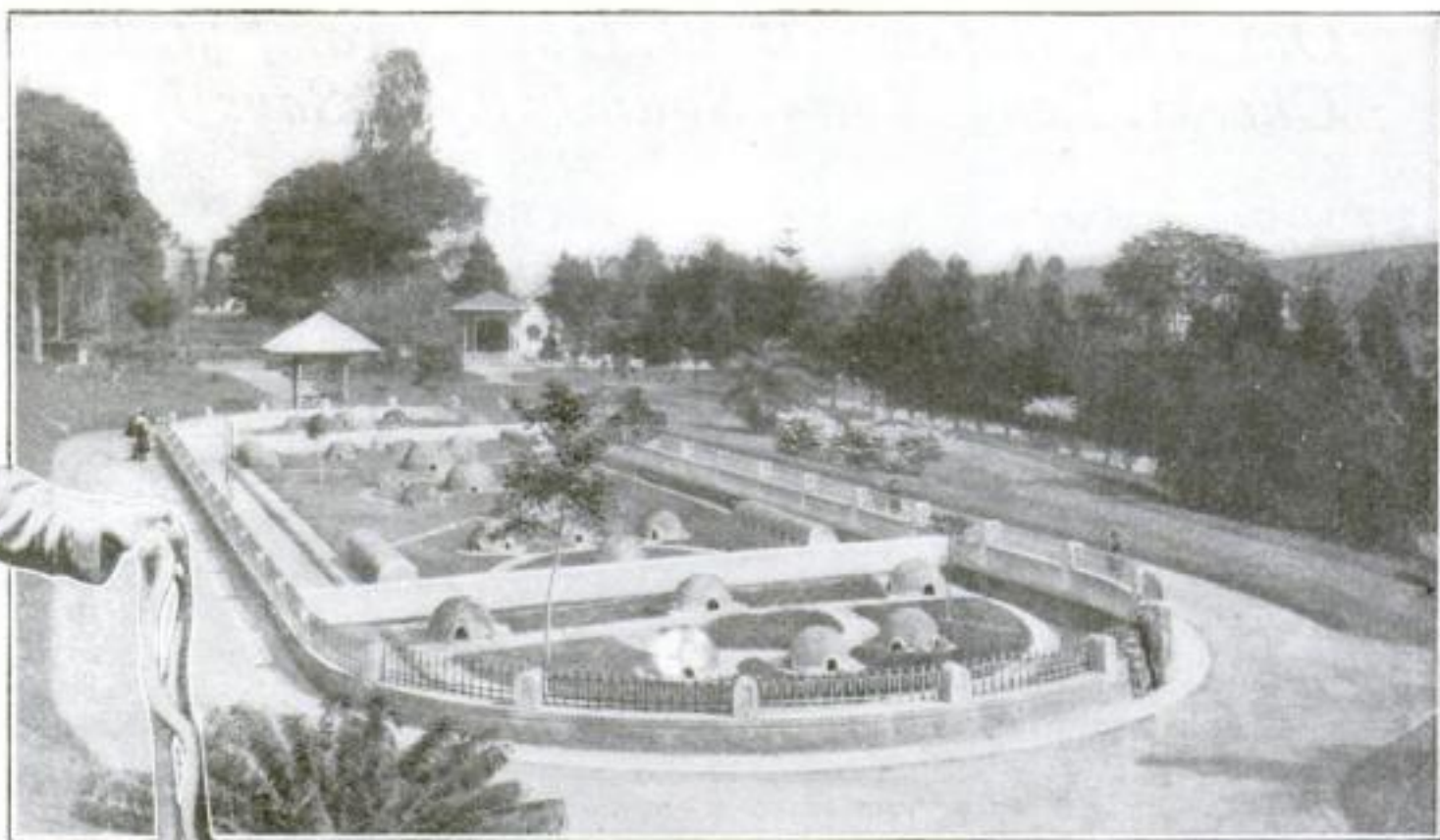
WHAT is more, these changes are taking place much more rapidly than generally is supposed. The modern type of man appeared in Europe at the close of what is called the "Mousterian Period"—as lately as some 22,000 years ago. He was bigger in his brain, stronger in his jaw, and had a more rugged countenance than his direct descendants of today. Some of his characteristics have rapidly toned down, while others are becoming more accentuated. His prominent cheek bones have been sinking in; his rather flat and wide nose has been jutting forward and becoming thinner; his mouth is still getting smaller and his chin is receding.

"It may be said," declared Keith, "that the changes I have described are due to diminished use of the jaws in modern people. . . . I do not think we can accept this as a true explanation, for the changes I have described are confined to about 30 per cent of the modern population; 70 per cent show no such change, and yet all live on approximately the same dietary. The cause lies deeper than a mere disuse of jaws; certain stocks and families show these changes more than do other stocks and families. Such evidence as I have gathered points to an increasing frequency of these new characters during recent centuries. Apparently evolution makes its conquests in the way just described; progress is made by climbing the scale of percentages."

Snakes *Are Safe if You Know*

A Home for Reptiles

The only snake farm of its kind, at Sao Paulo, Brazil, where venom is used to make snake-bite serums. Below: How one of the attendants handles the deadly reptiles



The igloo-like snake houses are surrounded by stone wall and moat

What I Have Learned of Venomous Serpents at the Strangest of Reptile Farms—A Cure for Deadly Bites

TAKE this fellow, for instance—if he nipped you he'd leave enough poison in the wound to kill two or three men. You would die in fearful agony before nightfall. Your limbs would be swollen to twice their normal size, and your face distorted out of all semblance to your former self."

Joaquim, my guide at the Butantan snake farm, was speaking. Crawling about our feet were reptiles gathered from the jungles of Brazil and given free board in return for their deadly venom at this strange South American farm, the only one of its kind in the world. Collected at intervals, the venom is used in the manufacture of snake serum, practically the only thing that can save human beings from death when struck by a poisonous reptile.

As Joaquim sketched his encouraging picture of my hypothetical fate, he was hauling a dingy greenish reptile, four feet long, out from one of the small, dome-roofed dens that look like Eskimo igloos.

"A pretty specimen, isn't he?"

I couldn't agree with much enthusiasm.

"He's a jararaca," said Joaquim. "The notorious fer-de-lance, you know. I've seen men suffering horribly within three minutes after a bite by one of these fellows, and losing consciousness within another five minutes. Death from such a bite used to be inevitable. Now our snake-bite serum will save a man when he seems to be already in the last throes."

Joaquim slipped the jararaca over the hooked end of a stick he carried, and we moved on. The reptile's head and tail dangled toward the ground, and his forked tongue flicked in and out as he writhed impotently.

Joaquim was using his grotesquely burdened stick to point out other reptiles that were wriggling sluggishly through the grass of the inclosure.

"Just don't step on them, and they'll leave you alone," he said reassuringly.

"They couldn't strike through your gaiters, anyhow. All the employees here wear leggings, and that's the only protection they need."

"Here, take this one yourself," he urged, handing me the snake-draped rod he still was idly carrying. "Just hold him well away from your body, and you're safe. He can't reach you. He's helpless to do anything but writhe around unless he can get a good purchase on the ground. He can't strike unless half his body is on the ground, and he can't strike much more than a third of his length under any circumstances."

"Besides, they're all of them rather torpid these cold days," Joaquim added. "Look." He stooped down, seized another serpent right behind the head, and lifted him shoulder high for inspection. "A jararacuçu, this little darling. One of our deadliest species. He'll inject a cubic centimeter of poison at a shot."

WITH fangs showing, the five feet of snake hung inert.

"One of the men in our laboratory was bitten in the finger by a jararacuçu some time ago," said my guide. "Within half an hour he was blinded, bleeding at mouth and nose, shivering in a cold sweat and barely conscious. His whole arm was throbbing with indescribable pain. He was treated promptly with serum, but it was three days before he was fully recovered. Without the serum nothing under heaven could have saved him from a terrible end."

"Yes," Joaquim commented, holding the jararacuçu up in front of his face and eyeing him coldly, "you're a tough customer, you are. But



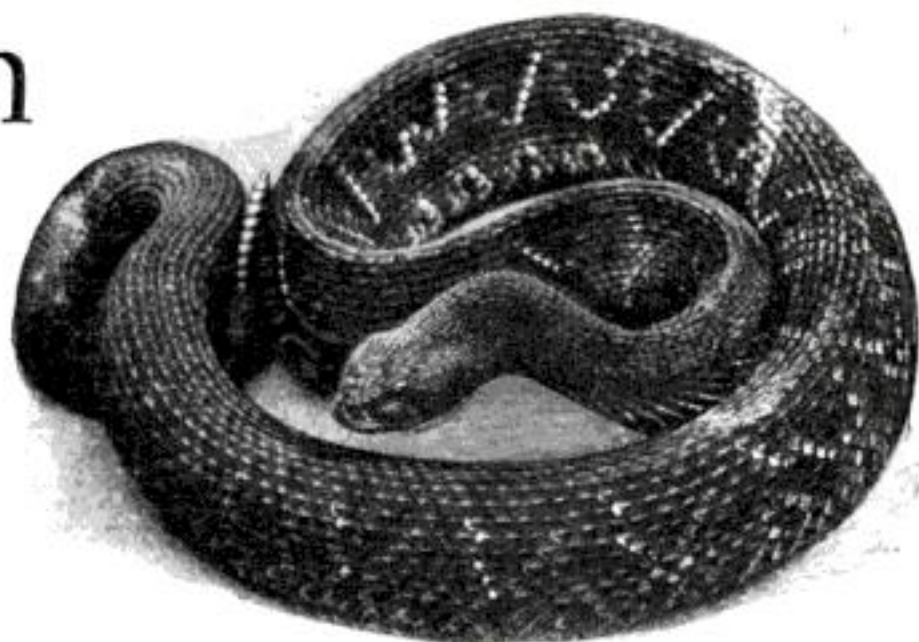
A Venomous Frog

Dangling a venomous Brazilian frog. Its poison causes blindness. Note the poison glands just back of the head

How to Pet Them

By FRANCIS GOW-SMITH

The remarkable experiences of Francis Gow-Smith—former Purdue football star and now an explorer in Brazilian jungles—in the world's strangest snake farm, are particularly interesting in view of the recent visit to the same farm made by Raymond L. Ditmars, curator of reptiles in the New York Zoological Park. Ditmars, took with him a quart of rattlesnake venom produced by 2500 snakes, to be used in the manufacture of snake-bite serum for the United States



Huge Rattler Coiling to Strike

The rattler is one of the most feared of all snakes—slow to act, but savage and deadly sure when it strikes. Its rattles—the number of them varies with age—may be seen at the tail tip

you're sulky these days, aren't you? This fellow hasn't eaten a thing for two months," he added to me. "I've seen some of our snakes fast six months or a year. But they aren't any the less poisonous when they're fasting."

He let the snake's dangling body slowly down onto one of the domes—then suddenly released his firm grip on the creature's neck and promptly departed.

"We don't take any chances, you see."

I TOLD him I hadn't seen him do anything but take chances so far, and I gingerly returned the snake he had consigned to my charge. I had come to the strangest snake farm in the world purely on business—not for the privilege of petting leashed lightning.

Fact of the matter is, I never did waste any affection on snakes. I've met them occasionally in the jungles, and I've seen Indians die horribly when bitten by them. Uncanny in motion, staring unblinkingly with cold, beady eyes, snakes look at man across one of evolution's bridgeless gaps.

After all, in an encounter with any other creature of the jungle, you fight more or less with the same weapons. You recognize a common inheritance of brain and eye and limbs and claws. But the snake, that weird survivor of an ancient and mistaken experiment in evolution, belongs not to this world but to another geologic age. Brainless, stupid, blindly vicious, he kills anything in his path, by the most mysterious of means—venom. Venom, that age-old, atrocious agency of treachery. The ultimate explanation of its deadliness is still a mystery, even down here in Sao Paulo, where Dr. Vital Brazil, director of the Butantan Seropathic Institute, has accumulated more practical information about poisonous snakes, I believe, than any other scientist in the world.

DOCTOR BRAZIL makes the only really effective snake-bite antitoxin to be had anywhere. He's been working on this for a quarter of a century, and has become very much of a hero to his fellow countrymen. They look up to him almost with awe.

And no wonder. Even as it is, 5000 persons die every year in Brazil from snake bite, not counting nameless hundreds of Indians.

At least another 20,000 are bitten and suffer gravely before recovery. The figures would be worse still were it not for Doctor Brazil's unremitting and energetic campaign against every species of poisonous snakes and his perfection and distribution of the antitoxins.

Snakes indeed are so grave an economic problem here that the government itself supports the Butantan Institute. Doctor Brazil estimates that reptiles cause his country a direct economic loss of \$8,000,000 annually. Only India, with its 20,000 deaths caused annually by the sacred cobra, has a worse record.

Ever since I began exploring the mysterious hinterland of Brazil, I have thought of it as a region over which the menace of poison broods ceaselessly. I have been assailed by the poisoned arrows of the Chervantes Indians. I have seen men suffering from poisonous wounds inflicted by scorpions, centipedes, tiny flies, huge spiders, and even by fish and frogs.

As soon as I finish writing this I shall turn northward again, across the last frontier and into trackless jungles where unfriendly Bororos prowl. There is no

antidote for the poison they use on their bone-tipped arrows. Frankly, I fear the snakes less, for the explorer seldom even sees a serpent. Yet it is folly to go into the jungle without snake-bite serum, and I came to Butantan to procure a supply.

Doctor Brazil tells me he is working to develop a serum to fight some of the other poison menaces. "We have a tiny fly," he says, "that bites and leaves only a red spot—no more annoying than a mosquito's bite. But gradually a sore develops, the infection spreads, and the whole limb rots away in ghastly fashion. I think we can conquer this with serum."

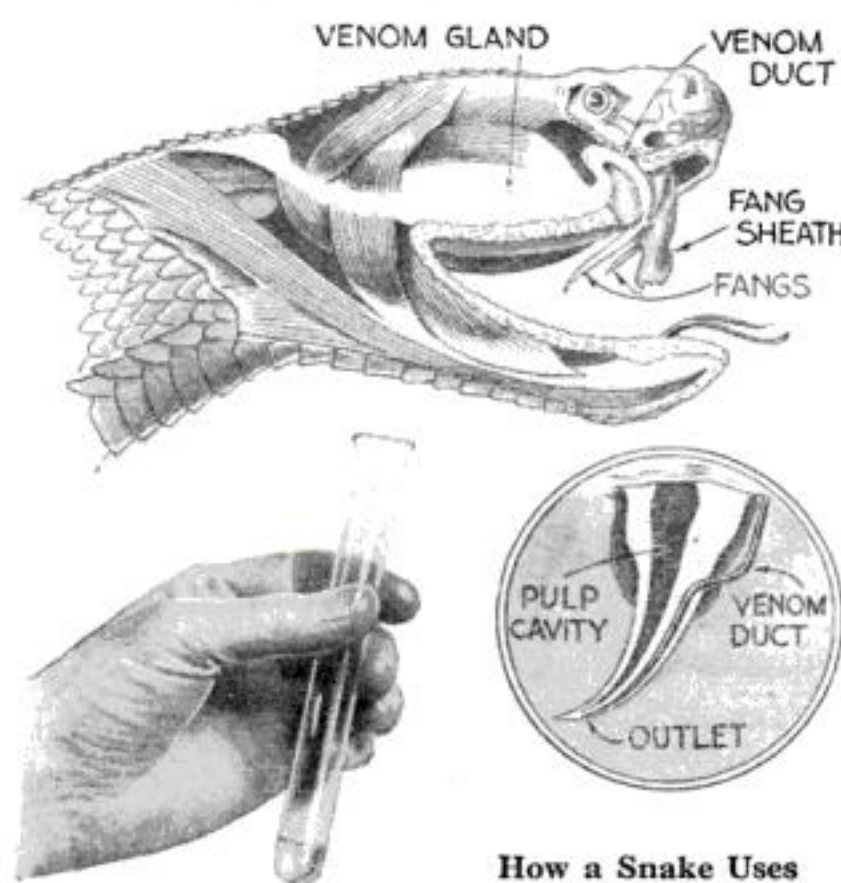
HE LED me into the laboratory and dangled a repulsive frog in front of my eyes. "His poison causes blindness." He put the frog aside to show me a monstrous spider, as large as a soup plate, that is nearly as dangerous as some of the five-foot snakes that wriggled over the lawns outside.

"Yes," said Doctor Brazil, "we have a fine assortment of venom-using creatures down here."

The Seropathic Institute at Butantan, which is a suburb of the city of Sao Paulo, consists of the laboratories, the stables where the serum-producing horses are kept, and a number of walled inclosures for the snakes. Each inclosure, with its dome-shaped dens, is separated from the low surrounding wall by a moat to keep the teeming snake population where it belongs.

AS WE picked our way through these inclosures, my guide pointed out the snakes that are most dreaded in Brazil. "That one with a dark gray pattern on a yellowish background is the surucucu. After the rattler's, his poison is the most virulent. He is swift and powerful and may grow 10 feet long. You've probably heard of him under the name 'bushmaster,' which in itself is dreaded by those who know it. You're more likely to meet one of these savage snakes in the virgin jungles, or near the streams, than any other kind. Look out for them."

(Continued on page 136)



How a Snake Uses Its Poison Fangs

The upper drawing shows how venom from a gland in a rattlesnake's head is discharged through a duct that leads to the two fangs. These fold back when the jaws are closed, and spring down into striking position when they are open. In each fang is a venom outlet, as shown in the circle. The test tube at the left holds one cubic centimeter of the amber-colored poisonous fluid discharged by a striking rattlesnake

Curiosities in Sport

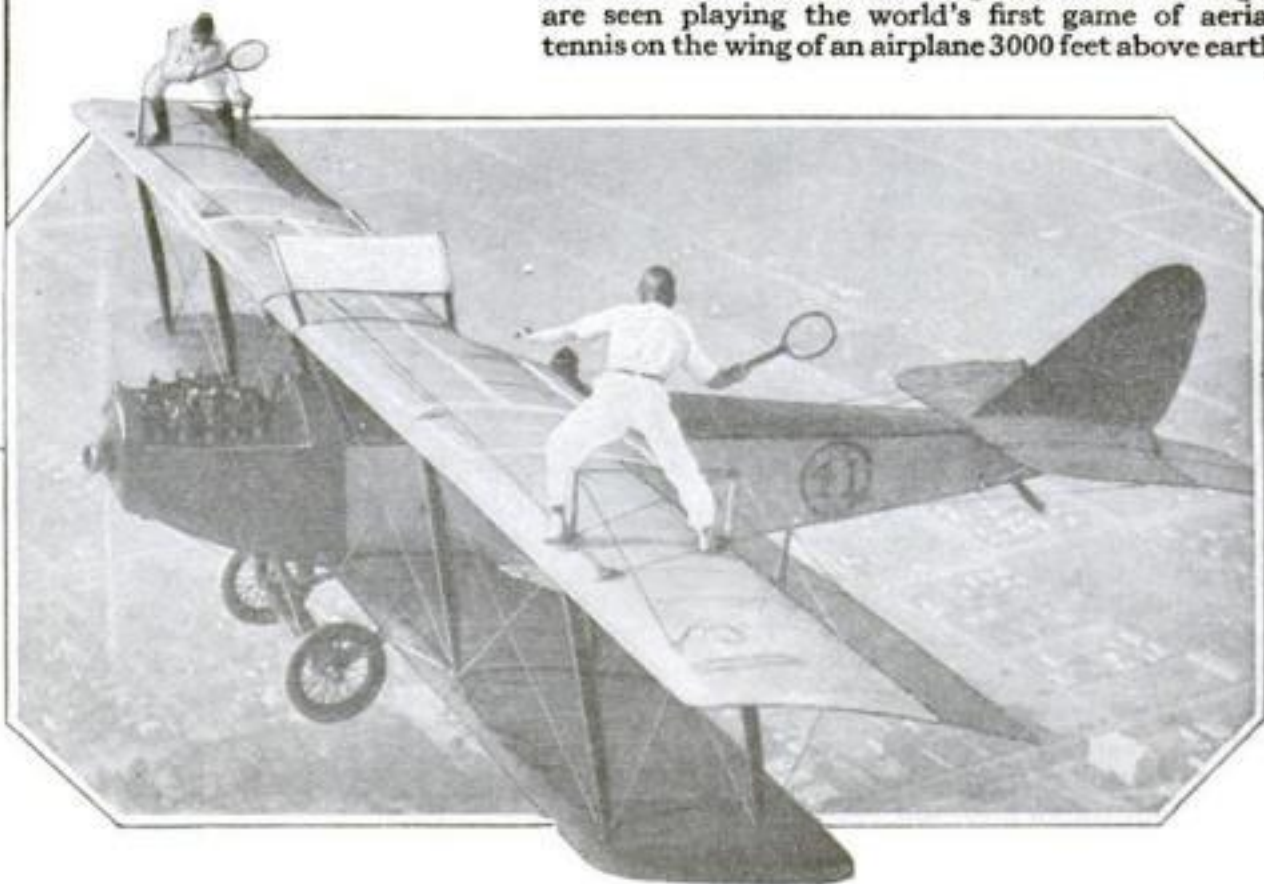
World's Series in Duplicate

The electric signboard that tells the play-by-play story of a championship baseball game was eclipsed by a remarkably realistic scheme tried out in Louisville, Ky., during the last World's Series. Every move of the game was duplicated by real players on a real diamond with the aid of radio and telephone. Each "player" wore head phones connected with a microphone in the press box through an ingenious arrangement of wires running around the player's belt and down to the soles of his shoes, making contact with copper plates on the ground. The report of each play was transmitted through the microphone to the players, who then acted the play



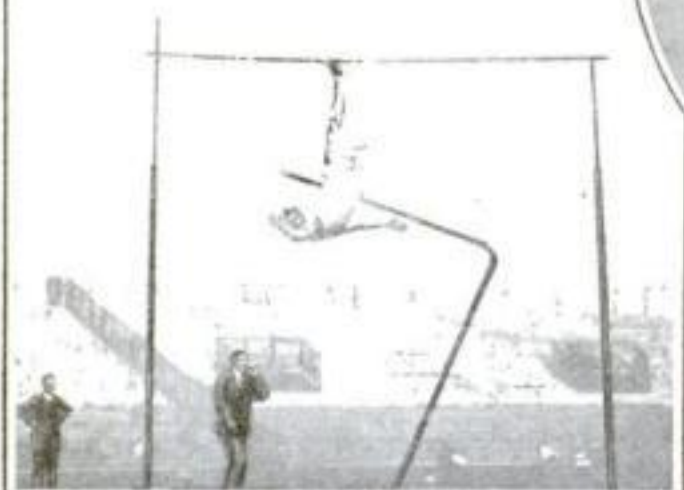
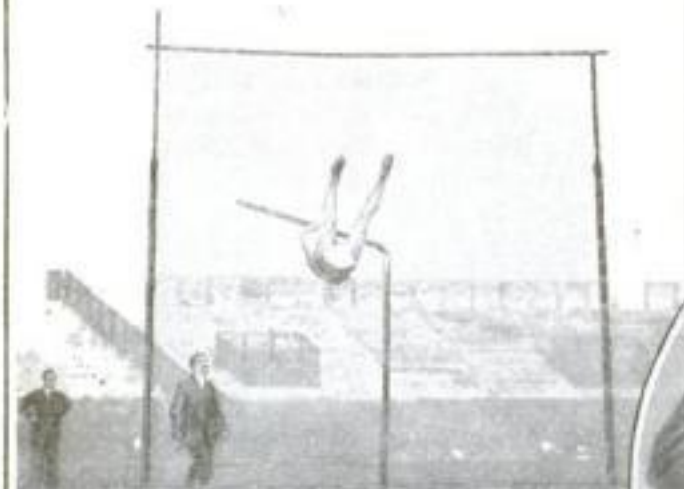
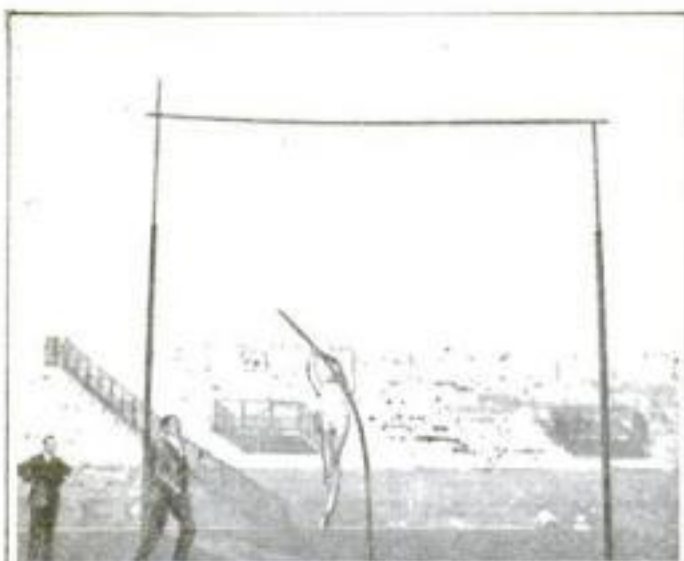
A Dizzy Game of Tennis

If you want to get a real thrill out of tennis you might try the stunt pictured below. Gladys Roy, famous woman flier of Los Angeles, and Ivan Unger are seen playing the world's first game of aerial tennis on the wing of an airplane 3000 feet above earth



When the Pole Snapped

Here are four of the most remarkable action pictures of a track event ever taken. They show Charles Hoff of Denmark, world's champion pole vaulter, at the moment his pole collapsed while he was attempting to break the record of 13 feet 9 3/4 inches at Colombes, France. A defect in the wooden pole caused it to give way at the center when Hoff had risen midway to the bar. Only by the narrowest margin did Hoff escape serious injury



What a Cleaner Has Learned about You and Your Clothes

How automobiles, ice cream, lipsticks, and radio leave their marks on your apparel—The difference between a moth hole and a spark hole—Where stains come from and simple ways to remove them

By Watson G. Clark

A WELL known New York physician stopped his car the other day before one of our dry-cleaning receiving stations. He hurried into the store, dropped a package before the girl behind the counter, and was out again before she had time even to reply to his words:

"Can't wait a minute, Miss Larkin. But you know what to do with this—don't forget the creases!"

The girl smiled. She opened the package, took out the suit of clothes, examined it, and made some notes on a card. The doctor has brought his suits to us every three or four weeks for years, and every one in the establishment who has anything to do with men's clothing knows what he wants. He wants every smallest spot, visible or invisible, removed. He wants his trousers creased down to the cuff, but the cuff turned up uncreased. His sleeves must be rounded without creases, and he won't wear a coat unless the lapels are rolled. He hasn't varied these requirements in years. He would send the suit back if we forgot and creased the cuffs. But he has us trained now, and we never do forget.

MEN who send us their suits for dry cleaning are more particular about the two creases in their trousers than any woman is about the plaiting of an entire skirt.

Dry cleaning has more to do with the fashion of the creased trouser than most people think. Before dry cleaning methods were known, clothes had to be washed with water, which makes them a shapeless mass. Gasoline, benzine, and naphtha, however, remove soil without affecting the garment's shape. They retain even creases and plaits—the final pressing merely sets them in more firmly. Dry solvents, in other words, are chemically inert as regards the fibers of the fabric. This cleaning method isn't so old, either, as generally is thought. It dates from 1856, when a Frenchman discovered that camphene cleaned clothes without affecting the fibers. The whole dry-cleaning industry

has grown from that simple discovery.

Speaking of creases, a popular movie actor recently sent us two suits to be cleaned. Our boy delivered them, carefully wrapped in a box, but when the

actor lifted them out, he said he couldn't use them. They were immaculate, but were not absolutely smooth where they had necessarily been folded in the package! Merely hanging them up would have remedied this, but he needed them for a set that afternoon, and the camera photographs every smallest hollow and pucker. Well, we took the suits back, resmoothed them, and delivered them that afternoon over the arms of uniformed boys from the movie studio.

PEOPLE speak of the dry-cleaning industry as a laundering business. More exactly, I think, it is a chemical business. The removal of stains from clothing requires not only a knowledge of chemistry, but the equipment of a miniature laboratory. Our men customers appreciate this far more than women. They seldom attempt to remove stains themselves, but women almost always do, to the despair of our spotting department when the garment is finally brought to us.

For example, a woman the other day brought us a silk dress, pointing out a yellowish stain, which we later found impossible to remove entirely. She said she first had tried a solution of oxalic acid on a stain and, when this failed, had resorted to permanganate, without rinsing the oxalic acid from the fabric. Women who are otherwise of a cautious temperament seem to take the wildest chances when it comes to saving a dry-cleaner's bill.

IF THEY could see the modern equipment of the stain-removing department in a dry-cleaning plant, they would hesitate before taking even a grease stain out of a tablecloth! We call the man whose job it is to remove stains, the "spotter." The spotter's tools range all the way from an air gun to a card-index drawer holding stain-removing formulas. His stock chemicals, such as chloroform, acetic acid, ammonia, alcohol, benzol, and so on, stand within reach. So does another collection of prepared mixtures and sol-



Watson G. Clark, President of the Barrett Nephews Co., New York City, one of the largest dry-cleaning establishments in the world

"MEN are more particular about the two creases in their trousers," says Mr. Clark, "than any woman is about the plaiting of an entire skirt.

"Cigarettes and burned matches cause the most holes in men's suits. Moth holes come next. Battery acid from radio outfits is a close third.

"Every time I see a man resting his elbow on the counter at a soda fountain I want to ask him if he knows the risk he is running of ruining his sleeve.

"You can't tell a man's occupation from the suits he sends us. Judging from the appearance of the clothes we get now and then from some prosperous business men, they might be hod carriers.

"Chewing gum, malted milk, condensed milk, ice cream, indelible ink, road oil, perfumes, battery acid, lipstick and rouge—these are leaving the finger prints of the twentieth century on our clothing."

vents. Other parts of his equipment are:

A spotting bowl on a swinging arm, for stains that are removed best by stretching the fabric over the bowl and pouring a cleanser on the material.

A vacuum tool that the spotter places underneath the stain, to draw off the solvent or water applied from above.

An atomizer or sprayer that may be operated by air pressure from a compressed-air tank.

A blower for quick drying.

A swinging sleeve board for working on sleeves, and, of course, a small sink.

HOW do people get holes in their clothes? Cigarettes and burned matches cause the most holes in men's suits. Moth holes come next. It is interesting to study these holes under a microscope, for the fibers then show up broken in a characteristic way, according to the cause of the hole. For example, pure silk, when burned with a cigarette, swells and forms a bead of char, easily distinguished under the microscope.

People usually are not sure themselves what caused holes in their clothes. When there is any question, we use not only the microscope, but also the litmus-paper test to determine the cause.

For example, a woman came in the other day, much excited because her husband's suit came back from dry cleaning with three little holes in the back of the coat. She kept saying she was sure we had used corrosive "chemicals" on a perfectly good coat.

We took the coat to the spotting table and dampened the margin of the hole. We then pressed a piece of litmus paper to the dampened cloth. If acid had been present, the paper would have turned red, but it didn't. Then we pressed on a piece of red litmus paper—if the damage had been due to an alkali, the paper would have turned blue. But neither test gave a chemical reaction. So we examined the fabric under the magnifying glass. This disclosed a thin film, a snow-white, gauzelike structure, all about the hole, such as is formed by the attachment of a cocoon or some insect.

WE TOLD this to our woman customer, and she finally admitted that her house had been infested with moths last summer, and that she really hadn't examined the coat carefully before sending it.

Men who have radio outfits at home are close runners-up to moths, in the damage they do to the family wardrobe. A little battery acid on your hand and a light touch on a dress or coat, and a hole is almost certain to appear sooner or later, depending on the kind of fabric.

Battery acid is sulphuric acid, and thanks to the popularity of radio, it is one of the most destructive agents now

causing trouble to the careful dry cleaner. The action of the acid may not be detected for weeks or months. Then, when the garment is sent to the dry cleaner and cleaned, a piece of the fabric, carbonized by the slow but deadly action of the acid, drops out. There is absolutely no way that the cleaner, prior to the accident, can know that the garment had been exposed to this destructive element, if the customer himself does not give this information.

Most people are amazed, too, to learn the number of other corrosive acids, salts, and alkalies commonly used around their own homes. The cuticle remover a

times appear in steaming, drying, and pressing.

The other day we received from a woman a fine bedspread, worth about \$150. It was linen, embroidered with colored wool. In laundering, the color had run from the wool into the linen, and our job was to take out the color that had run. Our first step was to set the color of the wool. We then immersed the spread in a plain soap-and-water bath, swishing it gently around—when immediately several large pieces dropped out of the fabric, leaving great holes. Nothing in the water bath could have caused this. What had happened was that in some previous attempt to remove the stains an acid, probably sulphuric, had been used and left in the fabric, to do its corroding work unnoticed.

That same week we received from a hotel an Oriental rug. Upon examination, we found it contained a large hole, more than a foot in diameter. We thought it might have been caused by the battery acid from a radio set. On calling up the hotel, however, we learned that a tea table had been standing for more than a year over that particular spot. The combination of tea and sugar, spilled on the rug, had slowly eaten away a hole that took our Armenian weaver several days to mend.

People often ask me if we can't tell a man's occupation from the clothes he sends us. Well, Mark Twain sent us his famous white suits at the rate of one a week, winter and summer, year after year. He wouldn't tolerate the smallest spot. If a drop of mud splashed on his trousers—off to the dry cleaner with the whole suit!

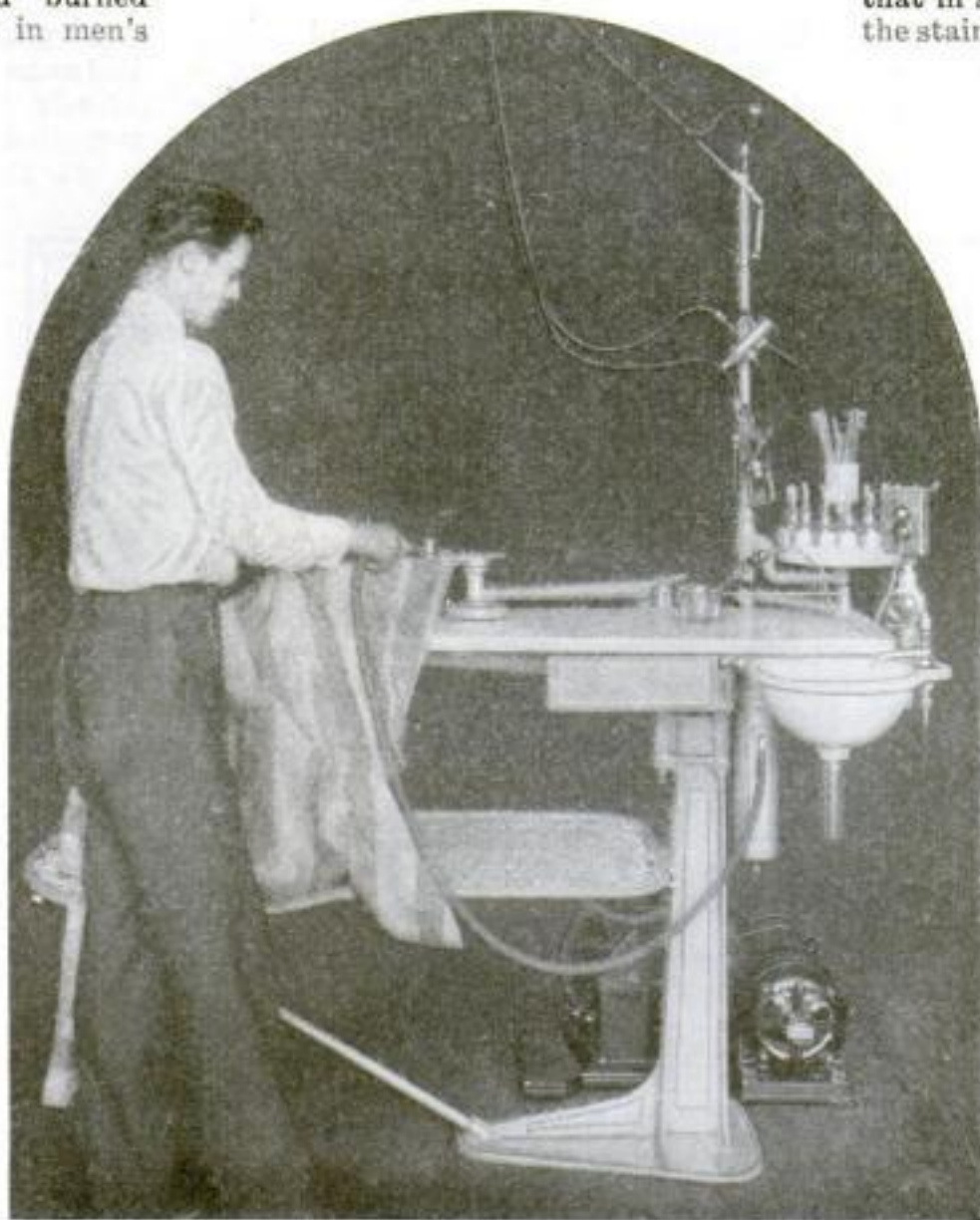
But that doesn't prove that all of our white-suit customers are Mark Twains, or even writers.

On the contrary, the remarkable thing to me is that you *can't* tell a man's occupation from the suits he sends us. We find business men, as a class, the most particular about their clothes. On the other hand, judging from the appearance of the clothes we get now and then from some prosperous business men, they might be hod carriers!

A DETECTIVE, perhaps, might make a pretty close guess at your occupation from the corroding materials traced on your clothes. If you are in the automobile repairing or manufacturing business, you are probably in daily contact with the sulphuric acid in storage batteries; the caustic soda in nickel iron batteries, soldering fluxes (hydrochloric acid) and so on.

If you are a barber, you play around with silver nitrate for antiseptic, and alum and ferric chloride to stop bleeding. If you have anything at all to do with

(Continued on page 142)



How Stains Are Removed

The "spotting" table, most improved scientific equipment for removing stains from clothing, is in reality a miniature chemical laboratory. The "spotter's" tools range all the way from an air gun and vacuum cleaner driven by motor to a card-index drawer holding formulas for stain removal. Stock chemicals, mixtures, and solvents stand within his reach.

woman uses in manicuring looks colorless and harmless enough, but I have seen a skirt that once had been splashed with it become eventually peppered with holes. The metal polishes, ink eradicators, and shoe cleaners in your home may contain oxalic acid, which puts holes in plant fiber and weighted silk when dried on the fabric. Corn and wart removers usually contain acids corrosive to fabrics.

Every time I see a man at a soda fountain spill soda on his coat, I want to tell him to wash it right out with water, even though it is apparently hidden in the fabric. Soda-fountain drinks often owe their flavor partly to acids that cause holes long after you have forgotten having spilled anything. Often these stains do not eat the fabric until heat is applied, which explains why holes some-

Another Eclipse—What It May Tell Us

By Newton Burke

THE total eclipse of the sun last January presented to thousands of us the opportunity of witnessing a spectacle whose awe-inspiring splendor we shall never forget. Darkness creeping over the snow; weird, flickering shadows that appeared from nowhere; the dazzling sun gradually obscured until at a breathless moment the greenish gold corona leaped from the rim—these are the memories of a lifetime.

On January twenty-fourth next, early in the morning, the tremendous scene of a total solar eclipse is to be repeated, but this time for a select little group of scientists who await it in the jungles of far-off Sumatra and Borneo. But because the last eclipse was witnessed by the largest number of persons that ever observed one of these rare celestial phenomena, the coming eclipse is awaited

with larger and keener interest, possibly, than any previous eclipse. What new things will be learned about the sun, the moon, the earth, the universe?

Scientists from all parts of the world now are gathering in Sumatra, Dutch East Indies, and Borneo, where the eclipse's path is widest and where totality will last three minutes and 10 seconds. Dr. Heber D. Curtis, of the Allegheny Observatory, and Prof. John A. Miller, director of the Sproul Observatory at Swarthmore College, set out last September on their journey half around the world to

The Moon's Shadow

The path of the total eclipse of January 24 will extend from Africa to the Philippine Islands. The black portion of the band, 89 miles wide, represents the umbra, or total shadow; gray portion, the penumbra, or partial shadow.



witness the event. Professor H. T. Stetson of Harvard and Dr. J. A. Anderson of Mt. Wilson Observatory also went from America.

Thousands of dollars have been spent in the transportation and setting up of scientific equipment, all on a gamble, for always there is the possibility that clouds will intervene and make all the preparations valueless.

Starting at dawn, local mean time, the path of the eclipse shadow will range from a point in Central Africa, south of the Sudan and north of Lake Victoria, along the equator, across the Indian Ocean to south Sumatra, thence to Borneo and Mindanao in the Philippine Islands. Radio will keep you informed of its progress as it sweeps over these distant regions at a cannon-ball speed of 1388 miles an hour. The total eclipse is due to arrive in Sumatra at approximately 2.25, local mean time. There the shadow of the moon will have a width of 89 miles. The eclipse will last two hours and two minutes.

IN THIS brief flash of time, while the moon passes between earth and sun, blotting the latter from view, the scientists will attempt to add a few more details to our understanding of the universe. For one thing, they will try to measure the light of the corona. An attempt to do this at Harvard University last year failed. The observers also may be able to determine the edge of the moon's shadow path on the earth. This observation involves the problem of the exact distance of the sun from the earth. If we could establish this distance, then man could measure all celestial distances.

Is Your Memory Really Bad or Just Badly Managed?

Most of us are too lazy to remember properly, says an expert—
Useful tricks for recalling names, faces, and telephone numbers—Why a young man usually has a better memory than his father—A dozen ways to test yourself

By Robert S. Woodworth, Ph.D.

ONE day recently a young man came to me discouraged. "I simply haven't any memory," he complained. "I never seem to be able to remember a thing I read."

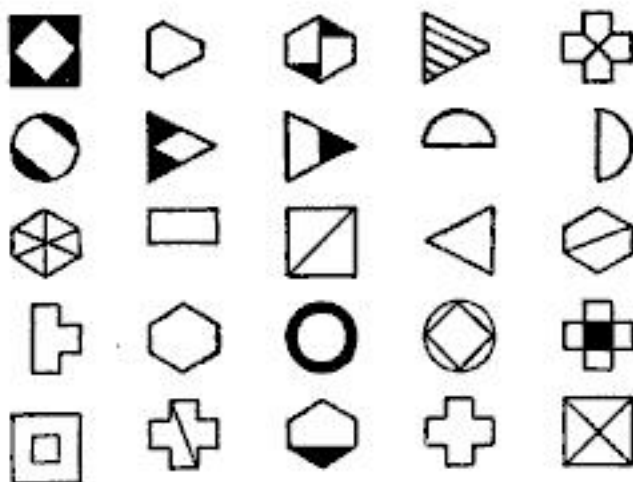
"Perhaps you haven't given your memory a chance," I suggested. "Suppose we test it."

I tried him with numbers. To his surprise he found that he could remember nine numbers repeated to him successively, and even repeat seven backward. He learned to repeat a stanza of poetry in a full minute less than it took the average person, and in other tests he scored high.

The fault clearly was not in his memory, but in the way he used it. He had been in the habit of reading passively without thinking while reading, without analyzing the important parts. He had given his brain nothing to remember.

Many persons are like that, for recent psychological tests have resulted in the surprising but encouraging conclusion that most of us have more memory power than we realize. In other words, if you forget easily, the chances are that the trouble is not your memory, but the way you man-

Dr. Woodworth is Professor of Psychology at Columbia University, and former Chairman, Division of Anthropology and Psychology, National Research Council



Can You Remember Pictures?

Study these 25 forms for one minute. Then turn to page 149, where you will find a group of 50 forms, among which these 25 are hidden. Check each of the forms that you remember, scoring yourself one point for each one that you check correctly, and deducting one point for each that you mark wrong. If you remember 7 out of the 25, it is a good score

age it. And you can improve your memory immensely by improving its management.

The memory process involves three steps: (1) Forming connections in the brain. (2) Retaining these, and (3) Putting them into activity again when occasion arises.

Most persons who try to improve their memories believe that if they could retain facts, they would be all right. The truth is that no one can do much about this middle step. Your power there depends almost entirely upon your physical makeup.

Some brains are more plastic than others, and impressions remain longer in these than in others.

Things begin to stick in the brain after three years of age, and from then up to 20 years the power of retention grows. From then to about 40 it remains the same, after which it diminishes. A man at 50 may seem to possess a better memory than the man of 20, but this is due probably to better judgment and organization of material than actual power of retention.

I know an old retired army officer who can sit for hours telling of his experiences in the Civil War. "What a remarkable memory!" his hearers exclaim. As a matter of fact, his feat is due to the reason

that his memory has become poorer and he can remember nothing new. Daily events make so little impression on his brain, which is more or less rigid, that the early impressions are thrown into high relief.

About the only way you can improve this power of retention is through general hygiene, which keeps your brain in good condition. Intoxicants and illness often weaken brain connections. But if you have good health and take care of yourself, you need not worry about retaining the connections. The important place to concentrate in improving your memory is in establishing the connections well by getting things into your head in a connected way. It is because of this that you can succeed if you deliberately set out to improve your memory.

First, however, it should be noted that improvement will come not in general memory power, but in special fields. Psychologists, after testing the memories of many people, say that training does not improve the general faculty of memory, but simply increases the ability to do a particular kind of memory job. If you want to remember faces, you must

Try This — — —

EACH of the numbers listed below has one more digit than the preceding one. Have some one read the numbers aloud to you, one at a time, allowing an interval of one second between each digit. After each complete line is read, you are to repeat it from memory as best you can. See how many you can remember correctly. Eight is a good score. More than 11 is highly exceptional.

1
6 7
3 4 9
5 1 2 7
8 4 5 8 3
9 2 2 6 1 7
4 3 6 8 2 7 3
1 7 8 7 3 3 4 6
9 2 5 1 3 2 7 6 4
8 4 3 5 6 1 5 2 9 7
2 5 9 1 7 6 8 6 4 9 5
7 3 2 8 4 6 1 9 5 7 3 8

— — — and This

BELOW are 10 sets of paired words. Read them over, associating each of the words in your mind with the opposite one with which it is paired. Now turn to page 149, where you will find the first words of the pairs listed in a different order. Opposite each write down its associate. After one reading you should be able to remember four or five of the associates; after two readings, seven, and after three readings, eight or nine.

freeze design
expensive snake
table lightning
overcoat purpose
parlor stretch
prefer instrument
tiger music
unfair smoke
fish guilty
sickness unseen

practise remembering faces. If it is telephone numbers, practise remembering them. If it is dates, practise dates. You won't learn to remember names by practising on numbers.

This gives a hint of the first suggestion I make—that is, to improve your general background in the special field in which you want to improve your memory.

MUSICIANS have performed extraordinary feats of memory in their particular field. Mozart, after listening once to the choir in the Sistine Chapel singing music not available in print, went home and wrote the whole thing from memory. This amazing feat has become classic.

A number of years ago, I attended a performance given by "Blind Tom," an old colored pianist who had lost his sight. After his regular concert he asked any one in the audience to play any composition, saying that he would repeat it immediately afterward. Often, I suppose, this was easy, but the day I heard him there happened to be in the audience a skilled organist, who played a learned piece of his own composition. We watched eagerly to see what would happen.

Blind Tom was a little fussed and in one passage hesitated for an instant, but otherwise went straight through the piece. The organist said that he had done very well.

NOW Blind Tom had not remembered that complicated piece note for note, but merely put together parts that were familiar to him. Through long study, musicians get to know phrases, successions of chords, and harmonies. When the organist played a certain phrase, Blind Tom grasped the idea instantly. To one who had no background of musical training, the feat would have been impossible.

Real-estate brokers seem to have amazing memories. They can tell you instantly about every tract of land for miles around—how much area each has, who's holding it, how much mortgage there is, and so on.

But when you analyze it, you see that it isn't so much that they learned isolated facts, as that they have a background of general facts about local real estate that fit all cases. They hear, for example, that a certain piece of property is held for \$15,000, but there is a heavy mortgage. To them this means that the owner has a small equity; that the property could be bought for very little cash. The price likewise gives them an indication of the size of the tract. All this goes through the real-estate dealer's mind when he hears the price. It is part of his job. He

How Many Objects Can You Remember?



Study this picture carefully for one minute and see how many objects you can find in the room. Then close the book and write down as many of the objects as you remember. If you remember more than 15, your score is good; 20 is excellent.

acquires naturally a background of facts without any deliberate effort to remember.

An actor, accustomed to the phraseology of the drama, can learn a long "part" very quickly. His memory seems remarkable, yet he would have just as much difficulty as any one else in pursuing a course in law, say, or learning the details of a commercial position. An actor who had appeared in several Shakespearean productions could commit to memory passages from an unfamiliar play by the same dramatist in almost the time

to whom all of the terms and ideas were familiar. All he would have to do would be to group together familiar facts. The actual amount of new learning would be small.

Probably the most spectacular of memory stunts are done with figures.

There was a man named Ruckle in Germany who could repeat 45 numbers in succession, forward and backward, and perform other astonishing feats. If you examined his history, you noted that he was obsessed with numbers from childhood.

When he saw the combination of 313, he recognized it as a prime number, one that can't be divided evenly by any digit. He knew all the prime numbers up to 1000—they were old friends and to him as familiar as single digits. He knew all the perfect squares, the roots, and so forth. Due to his background, he had a vocabulary of numbers of which you and I might be completely ignorant.

IF YOU improve your grasp of a certain subject, your memory in regard to new details of that subject will improve with it.

You can help yourself in getting the first connections well established by relating facts in large units—the larger the better. Blind Tom, the real estate man, and Ruckle illustrate this. The musician remembered whole passages instead of single notes. The mathematician remembered figures in combinations of three or larger, and the real-estate man remembered a group of related facts about a certain piece of property. Recalling a single fact in a related group brought all of the facts to mind. So in memorizing, try to link different elements together. If you can see them already bound, it means that much less work for you.

Interest in a subject helps a great deal in linking facts together. I know boys

(Continued on page 147)

A Test of Proverbs

READ these proverbs over once, taking about two seconds for each proverb. Then close the book and write or tell some one as many as you can remember. You should be able to remember at least six.

Make hay while the sun shines.
All's well that ends well.

Haste trips up its own heels.

Enough is as good as a feast.

Great hopes make great men.

Brave actions never want a trumpet.

A broken sack will hold no corn.

Feast today and fast tomorrow.

All is not gold that glitters.

Pleasing everybody is pleasing nobody.

He who begins many things finishes few.

Idle folks have the least leisure.

One hour today is worth two tomorrow.

Wilful waste brings woeful want.

New occasions teach new duties.

A stumble may prevent a fall.

Many hands make light work.

No news is good news.

Too far east is west.

Gifts make beggars bold.

Caution is the parent of safety.

The sweetest grapes hang highest.

Better late than never.

"When Trains Crash— Our Job Begins"

By Truman Stevens

*A Veteran Tells How
the Wrecking Crews Clear
the Track—A Week's
Work in a Few Hours*



What a Storm Did

In a few hours the wrecking crew cleared away this passenger-train wreck caused by a severe storm near Rockport, N. J. The photograph shows the wrecking crew, with powerful derrick, lifting a shattered coach off a hillside

EARLY one morning several months ago I was riding a sleeper on a flying trip from an Ohio city to New York when I was rudely jolted awake by a sudden grinding of brakes and lurching of cars as the limited came to a full stop. It so happened that the train had been speeding me to an important engagement in the metropolis that morning; and so, as I peered wide eyed into the darkness, it was with a feeling of dismay, a few moments later, that I heard the word passed down the line that there was a wreck ahead.

Two freight trains had collided—a moving coal train had crashed into a standing one. It was the kind of wreck every trainman dreads; for three of the four tracks of the line literally had been buried by the tangled wreckage of steel "hopper" cars and by piles of coal flung across the right of way by the crash. It was just the kind of a wreck, too, that might doom all my carefully laid plans for the day. Not only was I due in New York at a definite hour that morning, but my schedule gave me only four hours' time to transact my business there and to catch the only returning train that would take me back to Ohio in time for another and equally important appointment.

When eventually our train was switched over to the only clear track and we crept slowly past the scene of the disaster, the sight revealed by the first break of dawn was far from reassuring. Plowing into the standing coal cars, the locomotive of the moving train had flung itself on end and, breaking from its tender, had hurtled against a telegraph pole and keeled over

on its side. There it lay, a dying monster, gasping and hissing, while a wrecking crew made ready a giant derrick to lift its remains. Here and there hurrying men with flaring torches were cutting away at the tangle of steel cars; others were digging into the scattered piles of coal.

The work of "clearing away" had started. It was a job, I figured, that would take fully a day, if not two, and it would be 24 hours at least before normal traffic could be resumed on schedule. I gave up all hope of making a return trip that day.

Imagine my surprise when, after reaching New York and keeping my business appointment, I learned upon inquiry that the train on which I originally had planned to return would leave on scheduled time! The wreck had occurred shortly before five o'clock in the morning. By eight o'clock, only three hours later, all three of the buried tracks had been cleared sufficiently for scores of commuters' trains to pass through! And before noon, when I passed the scene a second time, there remained little evidence of the early morning catastrophe.

IT SEEMED the work of magic. That such a tremendous task could have been completed in a few hours so amazed me that at the first opportunity I sought out the freight trainmaster of one of the largest Eastern railway systems to inquire of him the secret of how it was done.

The trainmaster is the man on whom the burden falls whenever there is a wreck to be cleared. His is the job of rushing wrecking crews to the scene of

disaster at a moment's notice, of directing the work of giant cranes and acetylene torchmen. In his quick-thinking brain rests the responsibility of restoring normal traffic in the shortest possible time. I found him to be a man of surprisingly quiet voice and manner—a man accustomed to give orders of life-and-death importance calmly, with the assurance that they would be instantly obeyed.

"How is it possible," I asked him, "to clear away the wreckage of two steel coal trains in three hours?"

"A COAL wreck is the worst kind of a job we have to tackle," he replied. "The only reason we can clean it up so quickly is simply that it *must* be done. At this moment thousands of freight cars and passenger coaches are clicking over the rails of our division. Hundreds of thousands of passengers are depending on us to carry them on time to their work and to their homes. Hundreds of cars are transporting coal to heat the homes and office buildings of a great city. Other cars are laden with tons of fruit and other perishable products that might be ruined totally by delay.

"Just consider all that the movement of these cars means to the daily life of an immense population; and then think that anywhere, any time, some little mistake, some little piece of mechanism gone wrong, may throw a monkey wrench that will stop every wheel from turning. A towerman may 'daydream' for a brief moment; a switchman may pull a lever at the wrong time, a storm may undermine a single rail. Any one of these

things may paralyze a vast, smoothly running railway system."

The trainmaster paused, recalling, perhaps, disasters of the past.

"Whenever trains crash, our job begins, and then it is up to us to get the wheels turning smoothly again. It *must* be done swiftly, not only because on the resumption of traffic depend the comfort and convenience of thousands of people, but also because every hour of delay may spell tremendous loss to the railway company itself. Consider that a railway must bear the entire loss of perishable stuff such as fruit, if it is delayed and spoiled in transit, and you will understand one of the many reasons why speed is so important whenever a wreck occurs."

THE trainmaster's office, I found, like that of the chief dispatcher on the floor below, is an amazingly complicated, yet finely regulated emergency machine, of which the parts are human brains geared to think and act at top speed, with perfect precision, when occasion demands. The clerks go about their ordinary tasks calmly and easily; yet the call for action finds each at his designated post, with a definite duty to perform—a duty that is completed almost automatically.

Imagine yourself, some howling winter night, in the office of the chief dispatcher. A telephone bell rings. Somewhere out in the storm an engineer, scalded and bleeding, has staggered half a mile down the track to one of the telephones that are placed along the line at intervals of a mile for just such emergencies. It is his voice on the wire. Number 47 is in the ditch—jumped the rails—fireman killed—passengers badly hurt—!

The saving of human life comes first. Instantly the call goes out for doctors, nurses, and ambulances. Simultaneously

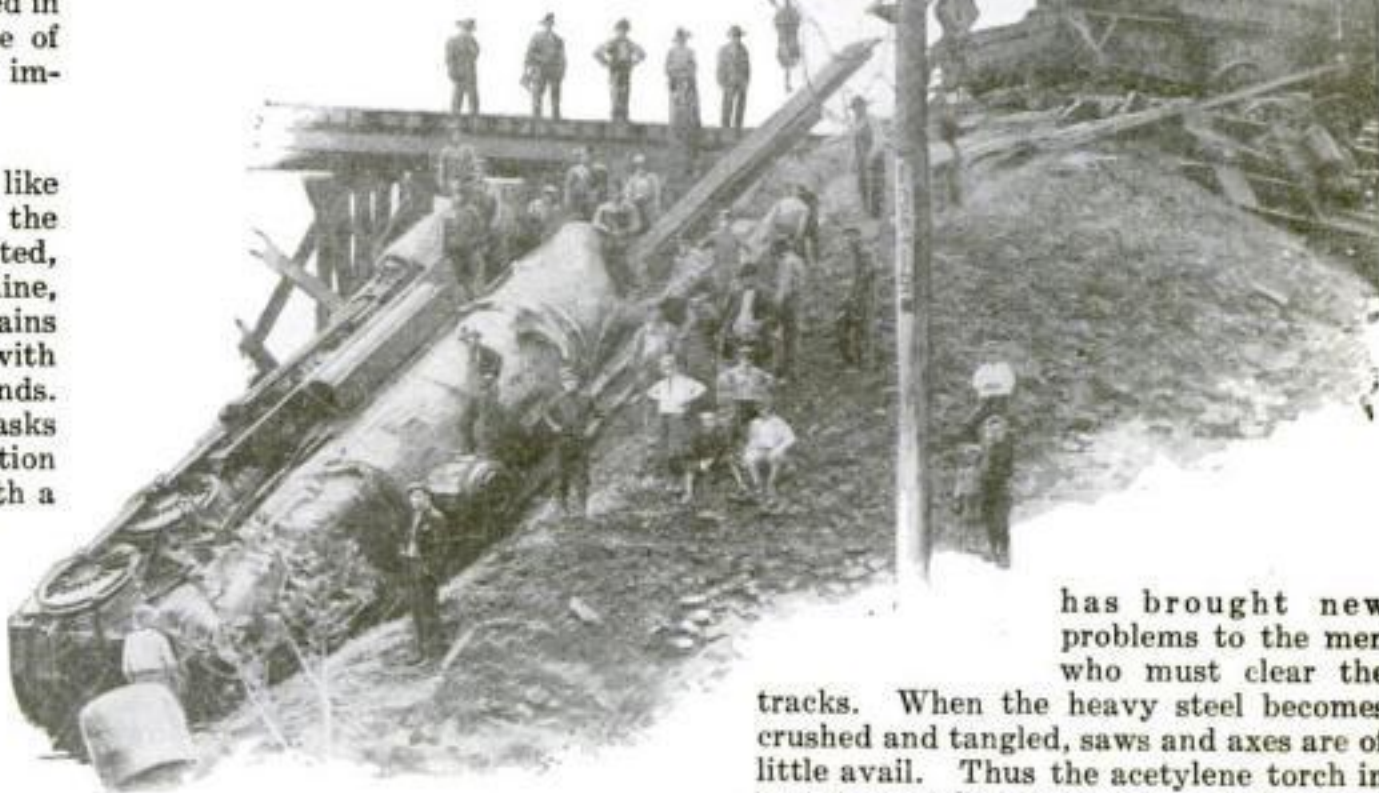


Your Life Depends on Him

The lonely track walker treads miles of railroad ties, tightening bolts on the rail joints to guard against the chance of derailment

the order is flashed for all trains on the division to stop until the full extent of the wreck can be determined. Officials of the railway, as well as state and Federal commissions must be notified. Already the machinery is in motion for an official inquiry into the cause of the disaster.

This much has been the task of the dispatcher. It has required only a few minutes—perhaps a quarter of an hour. Amazing, how swiftly men can move to the work of rescue in such an emergency.



Off the Bridge

A 150-ton wrecking crane preparing to lift a derailed freight locomotive that plunged from a railroad bridge in Wisconsin

"I remember one passenger-train wreck on a Western road," said the trainmaster. "An express, roaring along at 50 miles an hour, passed a certain block signal where it should have halted. In the signal tower an operator gasped, for he realized that a collision was certain; another train was speeding in the opposite direction on the same track. The operator jumped to the telephone and flashed word to the dispatcher. Doctors, nurses, and ambulances were on the way from the nearest point even before the collision had occurred!"

And now, with everything possible done to save human life and relieve suffering, the enormous task of clearing the rails begins. With the first report of the wreck, the trainmaster's orders have gone out to wrecking crews on duty day and night at several points on the division. In half an hour a fully equipped wreck train, with mighty cranes capable of lifting 100 tons and more, is moving toward the scene of the disaster.

AFTER its arrival, while great mechanical arms lift locomotive and steel cars bodily from where they lie sprawled across the rails, desperate efforts are in progress to get traffic moving once more. If only two of four tracks are tied up, the problem is comparatively simple, for trains can be operated on the other two. If three tracks are out of commission, the fourth can be used. If four tracks are out, however, some kind of a detour must be arranged. Either a new track must be thrown around the wreck, or trains must be detoured over a branch line or over the line of another company.

The use of steel cars, while preventing much loss of life and property in wrecks,

has brought new problems to the men who must clear the tracks. When the heavy steel becomes crushed and tangled, saws and axes are of little avail. Thus the acetylene torch in recent years has become one of the most important tools of the wrecking crew. Where brake rigging and running parts and bodies of heavy steel cars are massed badly, it saves time simply to burn them apart. Then the cut pieces can be lifted to the side of the track.

"THE most effective use of the torch I ever saw," the trainmaster told me, "was when two electric locomotives were wrecked at a tunnel entrance near New York. So tightly were they wedged at the entrance that they had to be cut apart. In the same wreck, the torchmen made a spectacular rescue of a trainman who had been pinned in an upright position in the vestibule of a steel car. In passenger wrecks sometimes the torches do great work in providing a way of escape for imprisoned travelers."

Steel railway equipment, too, has necessitated the development of wreck cranes of tremendous lifting power. In the New York terminal yards of a great railway system not long ago I found a derrick that within a radius of 17 feet will lift a weight of 150 tons, the strain of this weight being counterbalanced by outriggers. Two other derricks each had a capacity of 120 tons.

Thanks to improvements in safety devices, train wrecks are becoming fewer every year.

"But still we have to be ready for them when they come," said the trainmaster. "We have to jump at a moment's notice to handle anything, from the derailment of one car to a crash that costs many lives and ties up an entire division."

"Why do wrecks occur? Well, there are three chief causes—failure of man power, failure of equipment, and acts of nature, such as storms.

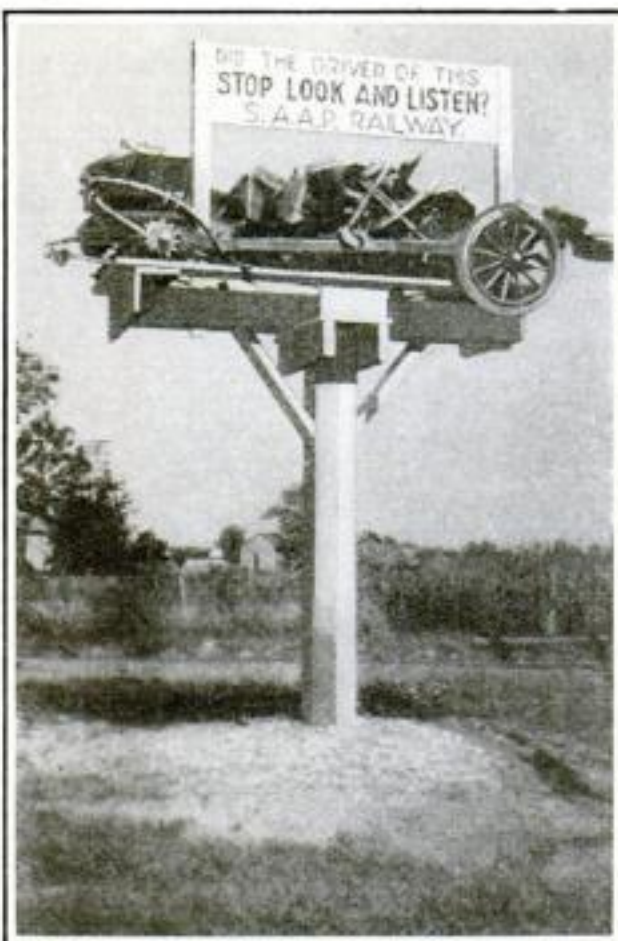
"A storm is the one big cause that is

beyond human control. Only a few months ago a frightful derailment occurred in New Jersey because a heavy rainstorm had washed sand across the tracks. Another fatal wreck was caused when a windstorm ripped the top from a freight car and threw it across a passenger track. Floods also are a frequent cause of wrecks that not even the most far-sighted management can guard against."

AS FOR failure of man power and equipment, these are recognized as factors that can be controlled and reduced. The railroads long ago learned that only the man with a clear, healthy mind, free from worry, can be trusted to work under high tension without fear of making a fatal error that might take tremendous toll in life and property. A railroad man who brings domestic troubles to his job is regarded as a menace. By making their men happy and contented, the railroads more and more are endeavoring to prevent costly mental lapses such as that which occurred a few weeks ago on Long Island, when a trainman threw a switch while the wheels of a passenger train were passing over it.

At the same time the railroads are constantly extending the scope of automatic control as a check against human fallibility.

Just this year automatic braking control mechanism was installed on the lines of at least three American railroads. Suppose, for example, that an express train, thundering through the night, passes a block signal. The engineer has collapsed at the throttle. A mile ahead on the same track, a freight train is lumbering up a grade. Just when disaster seems certain, there comes a flash of sparks from beneath the front trucks of the locomotive. Miraculously the express begins to slow down—50, 40, 30, then only 20 miles an hour. Now the freight is only half a mile ahead. A grinding of air brakes, an unseen hand closes the throttle, and the express comes to a full stop. A collision has been avoided without the



A Lesson to Reckless Drivers

How one American railway displayed a wrecked automobile as an object lesson to make other drivers think twice before trying the trick of beating a train at a crossing

touch of human hands. Such is the marvelous operation of the new automatic safety control.

HOW greatly the perfection of safety devices and the improvement of operating system and personnel have reduced losses from wrecks is evidenced by the records. In 1924, when 931,000,000 passengers were carried—about nine times the entire population of the United States—the fatalities from passenger wrecks were only 149—15 per cent less than the average for the preceding four years. Fewer railway employees were injured than in any year since the records were started in 1888. When you consider the vast network of rail lines that covers the country; when you consider, for example, that at one signal tower in the New York district 1400 trains pass in every 24-hour period, the record of railway accidents is truly remarkable.

But there is one potential cause of train wrecks that even the most perfect system and the most ingenious safety devices, it seems, have not yet been able to control. That is the ubiquitous automobile.

"There's nothing

that worries the trainman more than the careless motorist at the grade crossing," said the trainmaster. "It seems almost incredible, yet there have been numerous instances where a stalled car has derailed and wrecked the train that strikes it. Nor is it enough, it seems, to have warning devices and swinging gates at the crossings. I know of one Eastern railroad that reports it has an average of one gate a day broken by motorists who insist on running on the track when the barriers are down."

HOW the careless motorist is regarded by trainmen was illustrated strikingly following a serious wreck near New York. The automobile that threw the train off the track was buried beneath a tangle of steel freight cars on the edge of an embankment. Just as the members of the wreck crew were about to hoist the smashed motor to one of the flat cars that carried the train wreckage, the division superintendent interfered.

"Hold on, boys," he said. "Just leave that auto where it is, as a warning to other drivers."

So the wrecked car was mounted on a pedestal at the crossing where every passing motorist could view it.

In late years the careful investigation and determination of the cause of every wreck has been effective in preventing similar accidents. The old "cause unknown" no longer is accepted by the public nor by public commissions.

Very often the search for the cause is extremely difficult. An investigation committee will work for days at the scene of a wreck, but in the end they find a "lead" that brings a solution.

IN ONE puzzling case a train hauled by an electric locomotive had crashed into a passenger train, killing several persons," said the trainmaster. "The motorman claimed the air-braking system was defective. To find out whether he was right, a device known as the angle cock, which was believed to have caused the trouble, was taken from the wreck and installed on a dummy train. Here it was operated to determine whether its condition would cause an interruption in the air system. The test proved that the motorman's contention was right. Incidentally it led to improvements designed to prevent further accidents of the same nature."

So it is that the very men who are on the job when disaster comes, to sweep away the wreckage and set the wheels of traffic again in motion, are equally vigilant to guard against the need of a wreck crew. These men are vital parts of a marvelously keen system that today makes it comparatively safe for you to travel on trains, and that brings the necessities of life to you.



A Heavy Pull

Pulling a locomotive out of a river on the Panama Railway. Mechanical arms capable of lifting 100 tons and more aid the wrecking crews who work at top speed to clear the line for traffic

\$1000 More in Cash to Prize-Winners in Our Great "What's Wrong" Contest

*Read the Correct Answers and See
How Nearly You Were Right*

IF JOHN and Mary Newlywed had been surrounded by a group of neighbors such as the readers of POPULAR SCIENCE MONTHLY, never would they have been allowed to make the mistakes they did in their early bungling of jobs around the house. Such keen and astute critics you never met as those who pointed out errors in the third series of eight pictures in our great \$10,000 "What's Wrong" Contest, which appeared in the August issue.

The August contest was remarkable for the fact that the number of contestants who found all the errors correctly was four times as great as for the July contest. Consequently the three judges faced the extremely difficult task of deciding which of the many correct sets of answers were presented in the clearest and most skilful manner.

After long and careful consideration they decided that the first prize must go to M. Seklemian of Los Angeles, Calif., who with his wife is pictured at the top of this page. Perhaps Mr. Seklemian remembered schoolboy lectures on the worth-whileness of persistence and determination. Anyway, in this case, his

persistence brought him a reward of \$500 in cash. While working on the August contest he and his wife were camping on the Tioga Road in the high Sierras. The nearest post office was in the Yosemite Valley, 62 miles away. Time for getting in the answers was short. So the two set out and made the trip across the mountains, covering the 62 miles to the nearest post office. From there



Winner of the \$500 Prize

M. Seklemian, of Los Angeles, Calif., with Mrs. Seklemian. Together they journeyed 62 miles from their mountain camp to send their winning entry

The Three Best

THE first three prizes in the August "What's Wrong" Contest are awarded by the judges as follows:

FIRST PRIZE, \$500

M. Seklemian
Los Angeles, Calif.

SECOND PRIZE, \$100

Wrayburn M. Benton
Springfield, Mass.

THIRD PRIZE, \$50

Joseph H. Glasser
Cleveland, Ohio

Names of winners of the other 65 prizes will be found on next page.

Uncle Sam helped by speeding their entry to New York in an airplane. The answers reached the office of POPULAR SCIENCE MONTHLY just in time.

Mr. Seklemian's descriptions of the mistakes made by John and Mary, and of the deliberate errors made by the artist in drawing the pictures, were not only clear and accurate, but they were accompanied by excellent drawings of the Newlyweds doing each of the tasks in the correct way, with the artist's error in each case corrected.

AT THE bottom of the page is the picture of a man who is going to be surprised — Wrayburn M. Benton of Springfield, Mass., winner of the second prize of \$100. Until he opens his January issue of POPULAR SCIENCE MONTHLY, just as you did today, he will not know of

his success in winning one of the prizes.

When we wrote to Mr. Benton, asking him for his photograph, he was out of town on a business trip. His wife sent the photograph, saying that when he returned she would not mention having received our letter, but instead would let her husband have the surprise of finding his picture in POPULAR SCIENCE MONTHLY.

"I want to be there when he sees it," she wrote. "He will be delighted."

Looking at Mr. Benton, would you suspect that he was a poet? We don't know whether he writes poetry for a living (confidentially, we suspect not), but it was through humorous verse that he chose to point out John's mistakes in doing odd jobs about the house.

JOSEPH H. GLASSER of Cleveland, Ohio, wins the third prize of \$50. Just as Mary worked with John in putting up shelves and papering walls, so did Mrs. Glasser help her husband in figuring out the Newlyweds' mistakes.

"My wife and I spent together many interesting, somewhat perplexing evenings at work on the 'What's Wrong' pictures," he writes. In preparing their answers this young couple no doubt were aided by their own experiences, for it hasn't been long since they themselves started housekeeping. After putting to bed Joseph Glasser, Junior (a very important individual, aged one year), they got out their copy of POPULAR SCIENCE MONTHLY, and in the home-making struggles of John and Mary, they recognized some of the mistakes they themselves had made. Then Mr. Glasser got out his drawing board and very skilfully showed our artist just how the pictures should have been made. A snapshot of Mr. and Mrs. Glasser appears on the next page.

At the top of page 32 you will find the names of the winners of the five \$10 prizes, as well as the 60 winners of the \$5 prizes. See if your name is on the list.



Winner of the \$100 Prize

Until he sees his picture here, Wrayburn M. Benton, of Springfield, Mass., won't know that he is one of the successful contestants

Sixty-Five Additional Prize-Winners

FIVE PRIZES—\$10 EACH

Jacob Kleiner, Richmond Hill, N. Y.

Nina E. McLelland, Houston, Tex.

Irene M. Thun, Brooklyn, N. Y.

Mr. and Mrs. Gustave C. Lindquist, Los Angeles, Calif.

Louise Gardiner Walshe, Jersey City, N. J.

SIXTY PRIZES—\$5 EACH

Julius K. Andersen, Arcadia, Calif.
W. F. Armstrong, South Gate, Calif.
Paul J. Auxier, Omaha, Neb.
Wm. E. Barnaby, Beverly Hills, Calif.
Edwin F. Bramin, Balboa Heights, C. Z.
H. O. Bumann, Savannah, Ga.
J. H. Coman, Durham, N. C.
Pay-Lieut. J. O. Cossette, Esquimalt, B. C., Can.
Helen Culbertson, Hanover, Ind.
W. S. Cunningham, Shreveport, La.
Edward P. Drake, South Bend, Ind.
Frank M. Dugan, Utica, N. Y.
Mrs. P. Arthur Erickson, Seattle, Wash.
Chas. V. Fairchild, Los Angeles, Calif.
Ed. C. Fleischman, Detroit, Mich.
Harland G. Foster, Brooklyn, N. Y.
Angus W. Gordon, Louisville, Ky.
G. A. Graham, Baltimore, Md.
Milton A. Graves, Evanston, Ill.
David F. Gray, Kansas City, Kan.

C. R. Greenwald, Columbus, Ohio
George H. Groth, Cleveland, Ohio
Otto Alfred Hansen, Brooklyn, N. Y.
Walter C. Harris, Brooklyn, N. Y.
F. G. Hill, Fort Pierce, Fla.
F. P. Hodgkinson, New York City
W. B. Hughes, Wilmore, Ky.
John Intemann, Rockaway Beach, N. Y.
Mrs. W. A. Jacobs, Mt. Vernon, N. Y.
A. B. Kinney, Lima, Ohio
O. B. Laurent, New Roads, La.
Jos. P. Leahy, San Jose, Calif.
J. G. Lips, Louisville, Ky.
E. H. Lukenbill, Harrisburg, Pa.
Robert P. Lyle, Rivera, Calif.
John A. Malm, Denver, Colo.
Mrs. Clyde Mayne, Austin, Tex.
H. S. Merritt, Los Angeles, Calif.
Henry J. Meyer, Jersey City, N. J.
Nicholas Michel, Sulphur Springs, Tex.
Tom H. Miles, Washington, Ind.

Bernard Moeddel, St. Bernard, Ohio
E. A. O'Brien, Portage la Prairie, Man., Can.
William Otto, Eaton, Colo.
Orrin V. Overton, Janesville, Wis.
E. H. Parker, Hartford, Conn.
E. M. Riggs, Dos Cabezas, Ariz.
Halleck G. Ranger, Indianapolis, Ind.
A. L. Robinson, Stockton, Calif.
Harrison H. Schley, Waukesha, Wis.
H. G. Simmons, Kokomo, Ind.
Pearl Smith, St. Paul, Minn.
Harry M. Steed, Portsmouth, Ohio
Richard E. Stifel, Cleveland, Ohio
Mrs. Ivan R. Stubblefield, Cincinnati, Ohio
Howard H. Sweet, Attleboro, Mass.
L. E. Trueblood, South Bend, Ind.
Mrs. C. A. Tryon, La Salle, N. Y.
Stephen A. Yesko, Washington, D. C.
Rogers G. Young, Jr., Pawtucket, R. I.

A casual glance at the addresses of the successful contestants will show that they are scattered far and wide through the country.

Every one of the thousands of entries in the contest was gone over carefully and the judges based their final decisions on three points—accuracy, clearness, and skill of presentation. Many of the contestants whose answers were presented in excellent form, fell short of winning one of the cash prizes simply because of some slight inaccuracy in their answers.

ONE more month and then all of John's and Mary's troubles will have been solved. If you didn't win a prize this month, there still is a good chance that you may be successful in the September contest; for the results thus far in the \$10,000 Contest have shown that some of those who have been low on the list of prize-winners one month, or not on the list at all, sometimes have shot surprisingly to the top in another month.

Winners in the September Contest will be announced in next month's issue of POPULAR SCIENCE MONTHLY, and the winners of the Grand Prize Contest winners soon after that.

So that you can tell how nearly your own answers were right or wrong, the list of correct answers to the eight pictures in the August Contest are printed below. For each picture you were asked to tell, first, what John or Mary or both were doing wrong and why it was wrong; second, what deliberate mistake the artist made in drawing the picture.

In the following list of correct answers A in each case points out John's error; B is the deliberate mistake made by the artist in drawing the picture.

AUGUST CONTEST ANSWERS

Picture No. 1. A—John is hanging the screen door upside down. The smaller section of the screen should be at the bottom. B—The artist has drawn the woodplane with cutting blade reversed.

Picture No. 2. A—John has removed the whole faucet. He should have taken out only the valve mechanism. B—The artist has drawn the handle of the rake at a wrong angle with relation to the prongs, and the handle of the hoe at a wrong angle with relation to the blade.

Picture No. 3. A—John is nailing the edge of the board to the plaster of the wall. He should nail a wooden cleat to the wall for the shelf board to rest on. B—The back of the kitchen chair on which Mary is standing has been reversed by the artist.



Winner of the \$50 Prize

Joseph H. Glasser with Mrs. Glasser in front of their home at Cleveland, Ohio. Aided by their own recent experiences in home-making, they spent many evenings together discovering the mistakes of John and Mary

Picture No. 4. A—John is nailing down the linoleum as he unrolls it. He should not nail it down until he has fitted the whole surface completely, and he should wait at least a day or two until the linoleum lies flat. B—The artist has drawn the calendar to show 30 days for August.

Picture No. 5. A—John is thinning out the paint with water. He should have used turpentine. B—The drain plug for the trap on the kitchen sink pipe is shown on top of the curve instead of at the bottom, where sediment collects.

Picture No. 6. A—In tying the window weight to the new sash cord, John has left too much slack. The weight will strike the bottom of the compartment in which it slides before the sash is completely raised. He should have just enough cord to permit the weight to clear the bottom of the pocket. B—The artist has placed the sash-lift several inches from the center of the sash.

PICTURE No. 7. A—John is using a 50-cent piece to set the spark plug points. This will set them too far apart. He should use a dime. B—The artist has drawn the blade of the knife so long that it will not close into the handle.

Picture No. 8. A—John is storing the cement on the ground. The dampness of the ground will ruin it. He should store the cement inside or place it on boards and cover with rainproof material. B—The artist has drawn John's shadow too high for any shadow cast by the sun.

The names of prize-winners in the September Contest will be announced in next month's issue, together with correct answers to the eight September Contest pictures. Watch for the February number, on the newsstands January 10.

Where Old Houses Go

Every Scrap of Wreckage—Even Bent Nails—Can Be Put to Use

IF YOU live in a growing city, no doubt you often have watched workmen demolish an old house or business block to make room for new and larger buildings. In the crash of tumbling debris there is a strange fascination. In a few hours the work of months, sometimes years, can be reduced to broken brick or stone, shattered timbers, lumps of plaster, and crooked nails, fit only for the dump heap. Yet, as our artist cleverly shows on this page, practically every bit of this "trash" usually is salvaged and put to some useful purpose.



OLD BRICK USED TO FILL NEW ROADS



GRANITE AND LIMESTONE UTILIZED FOR GRAVE-STONES, MAUSOLEUMS AND HOUSE FOUNDATIONS

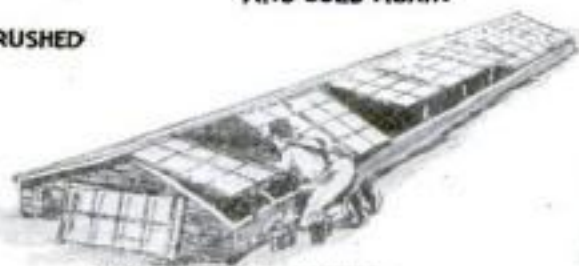


FLAGSTONES RELAI D AS GARDEN PATHS



SCRAP METAL REMELTED AND USED AGAIN

ALL SCRAP STONE CRUSHED FOR CONCRETE



WINDOW GLASS INSTALLED IN HOTBED FRAMES OR SHOWCASES



OLD BATHTUBS USED FOR CATTLE TROUGHS



PLUMBING FIXTURES REPLACED AND SOLD AGAIN

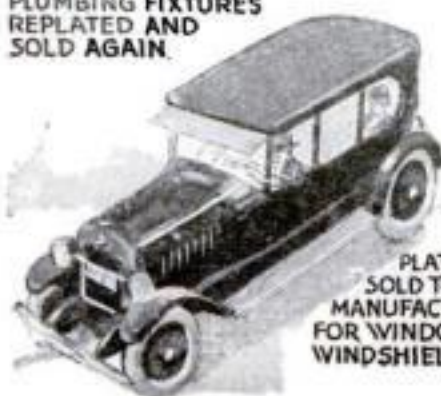


PLATE GLASS SOLD TO AUTO MANUFACTURERS FOR WINDOWS AND WINDSHIELDS



TILES RELAI D IN OTHER HOUSES

ALL PLASTER COLLECTED AND DUMPED TO FILL SWAMPY GROUND



HAND-RAILS, STAIR-TREADS, AND MOLDINGS USED IN BUILDING CHEAPER HOUSES



DOORS REPOLISHED OR REMODELED AND USED AGAIN

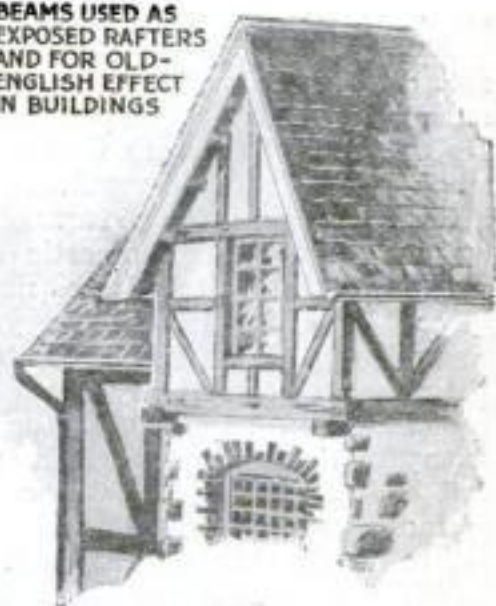
FLOORING MAKES GOOD SIDING OR SERVES TO REPAIR OLD BUILDINGS



Nothing Is Wasted

Each truckload of wreckage hauled away from the house that is being demolished reaches a useful destination. Some of the more important uses are pictured here. Even the smallest bits of scrap metal are collected, melted, and used again. Usually lumber, stone, brick, glass, and metals are sold on the site of the wrecked building, carried to yards on the outskirts of the city, and there reconditioned for sale to building contractors.

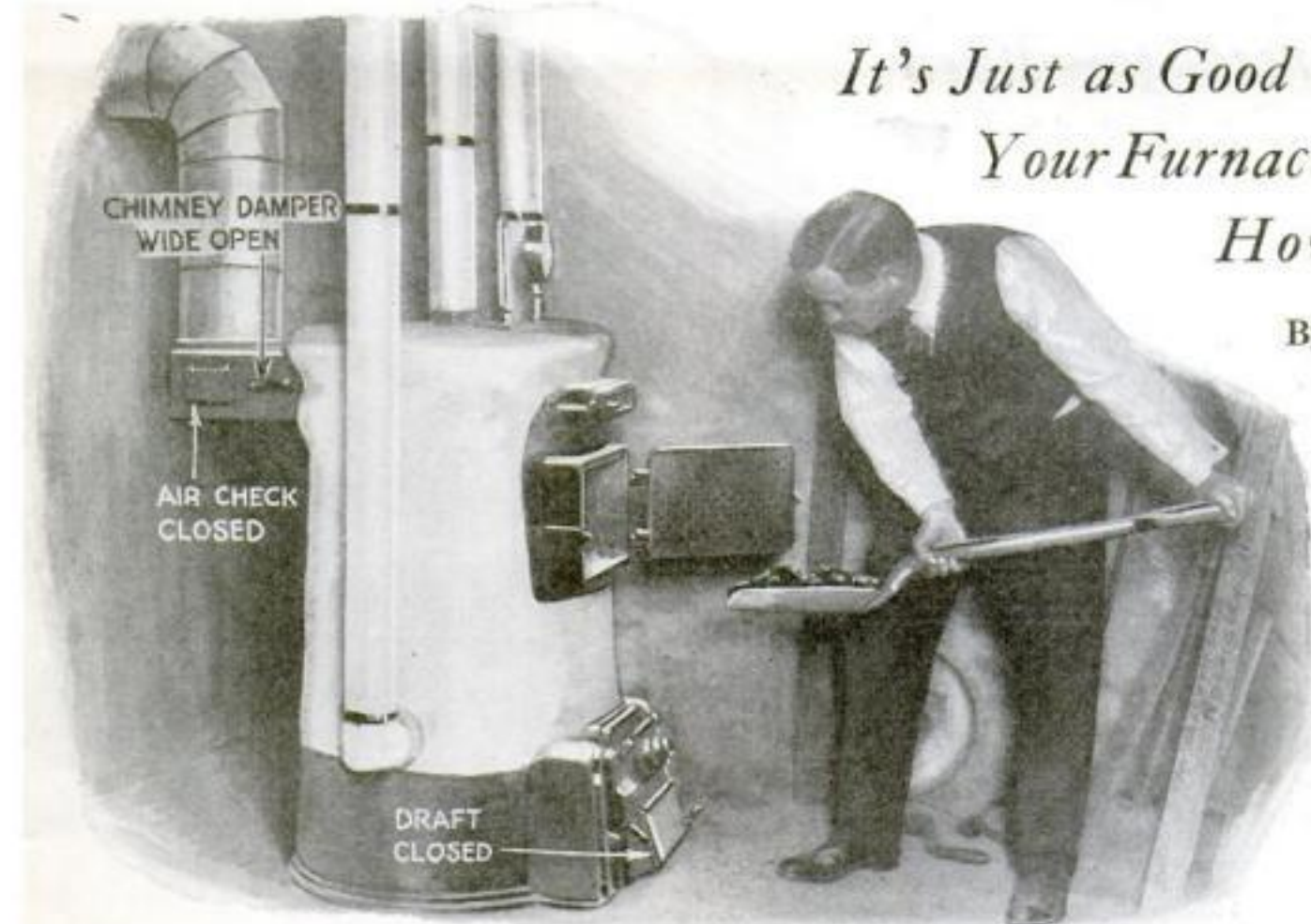
BEAMS USED AS EXPOSED RAFTERS AND FOR OLD-ENGLISH EFFECT IN BUILDINGS



Tricks in Burning Soft Coal

*It's Just as Good as Anthracite for
Your Furnace when You Know
How to Handle It*

By George Lee Dowd, Jr.



How to Prevent Gas in Fueling with Soft Coal

Since soft coal produces an immense amount of gas the instant it is added to your fire, it is necessary to keep the drafts closed and the chimney open when filling the furnace, in order to prevent the escape of gas into your home. This photographic diagram shows the proper arrangement of the various furnace openings when fueling to avoid gas escape.

WHEN, last fall, a strike shut down the anthracite coal mines, people who had been accustomed to burn this fuel were thrown into a state of panic. Many probably believed that they were likely to be frozen to death before the end of winter, because the impression prevailed that bituminous or soft coal, the most available substitute for anthracite, is an unsatisfactory fuel for domestic purposes.

As a matter of fact, properly used, soft coal is really just as good a fuel as anthracite and is considerably cheaper. Its only drawbacks are that it is a bit smoky and dirty and requires that more attention be given to the furnace. About 80 per cent of the domestic coal consumers in the United States never see a piece of hard coal from one year's end to another. With soft coal, they keep their houses comfortably warm and even use this fuel successfully for cooking. Many of those who always have burned soft coal, however, probably waste a lot of money each winter just because they fail to handle this fuel properly.

While anthracite or hard coal contains only about 10 per cent of volatile matter that can be driven off in the form of gas, soft coal is 30 per cent volatile and in addition contains much tarry, sticky material. When you burn soft coal, then, you must keep in mind the gaseous nature of the material and take steps to insure the combustion of the excess gas.

The first point to remember is that a soft coal fire should not be banked with a large mass of coal shoveled into the furnace at random. Whenever you add soft coal to the fire, a great quantity of

gas is produced almost at once. Consequently, if you bank the fire so thoroughly that the red hot coal is completely buried, the temperature of the top layer will not be high enough to ignite the gas and there is a good chance for an explosion. In banking with soft coal, therefore, you must be careful to pile on the fresh coal in such a way that at least one spot of red hot coal is left exposed to furnish a flame that will ignite the gas as soon as it is produced.

The second point to remember is that the tarry nature of soft coal causes it to form into lumps and cakes that impede the flow of air through the fire. This means that soft coal requires a good draft. Hence, you will have to keep the draft door open much more than for hard coal. The chimney damper should be open at all times, and it will be necessary to keep closed the door at the back or top of the furnace which, when open, allows air to flow directly into the chimney.

WITH hard coal a gentle shaking of the grate twice a day usually is enough to dump all the ashes. With coke the shaking can be even more gentle. Soft coal, though, requires a great deal more attention in this respect. In addition to shaking the grate twice a day, it is necessary to slice the fire two or three times every 24 hours. By "slicing" is meant inserting a long poker in the opening just above the grate—sometimes called the "clinker door"—and heaving on it so that the end of the poker will lift up and break the sticky lumps and cakes. If slicing is not done properly and often enough, the draft will be cut off

completely and the fire will go out.

In order to supply enough air to burn completely the large amount of gas given off by soft coal, the fire door should be left ajar and the chimney damper should be open. This insures that air will be drawn in through the fire door and prevent the escape of gas into the cellar.

THE most efficient way to test the flow of gas or air through the fire door is to light a match and hold it near the crack in the door. If the flame is drawn into the furnace, you may be sure that no gas is escaping. Be careful, of course, not to make the match test unless flames appear above the fresh coal. Otherwise the match may ignite the unburned gas and cause an explosion.

Many people do not realize that soft coal can be burned with entire satisfaction in the ordinary kitchen range, provided that the stove is equipped with a grate with reasonably small openings. However, if your stove and chimney are not arranged to supply a good draft, soft coal cannot be used.

The rules for burning soft coal in the kitchen range are much the same as for furnaces. Put on small quantities of coal at a time, keep the chimney damper open at all times, do not remove the stove lids, and slow the fire down by lessening the draft. Break up the lumps and cakes with a poker at frequent intervals.

That you shovel fuel on the fire and remove ashes regularly does not necessarily mean that you are getting all the heat out of the fuel even if the house is warm enough.

For real efficiency, three things are absolutely necessary in burning any kind of fuel, whether hard coal, soft coal, coke, or even wood. You must have air enough, you must have heat enough, and the air must be mixed properly with the fuel you are trying to burn. By mixed, I mean that the air must be mixed with the gases and in contact with the hot coals.

WITH these facts in mind you are in a position to make an intelligent examination of your own method of caring for your furnace, remembering, of course, that each kind of fuel requires a different treatment and that the size and type of your furnace, together with the

chimney arrangements, will affect results very materially.

Of all the solid fuels, hard coal or anthracite is the easiest to handle. It is composed largely of pure carbon in a hard, dense form, with only a small percentage of material that can be roasted out of it in the form of gases when it is exposed to heat. Because of this, the average user gets fair efficiency out of hard coal, especially during cold spells when the furnace is being pushed to supply as much heat as possible. With hard coal, the falling off in efficiency occurs mainly when the weather is so mild that it is not necessary to force the fire. To cut down the draft and so reduce the heat of the fire during mild weather, most home owners set the fire door ajar. This permits cold air to flow over the fire in excessive amounts and to cool the furnace without economy of coal.

THERE is likewise a steady loss when a hard coal fire is banked. This is due to the wasted gases that are roasted out of the coal and sent up the chimney without being burned.

When you smell coal gas in your house you are wasting fuel. Most home owners are satisfied if they can adjust their furnaces so that this noxious odor is not detected, but the fact that you cannot smell coal gas in the cellar or upstairs does not mean that it is not being produced in the furnace.

The carbon in the coal unites with the oxygen of the air during the burning process in two different ways. If there is an ample supply of air, the result of the burning is carbon dioxide. When there is not enough air, the oxygen unites with the carbon to form carbon monoxide, a deadly poison. And you can be sure that if you smell coal gas in your house, this injurious gas is present.

Fortunately, coal contains sulphur and



The Right Way to Add Fuel

This cross-sectional view of a furnace illustrates the correct method of fueling with soft coal. The coal is added so as to slope down from the back of the firebox, with live coals exposed in the rear. Without this opening to the live coals, the fresh coal will form into a tarry mass that will extinguish your fire. Keep chimney damper slightly open

the sulphur fumes give you warning of the danger, for carbon monoxide in the pure form is entirely odorless. Coal gas always is produced to some extent whether you use hard coal, soft coal, or coke. It gets out of the furnace and into your cellar when the chimney damper is closed too tightly. This is true even when the fire door and the fire door damper are closed, because the gas will leak out around the cracks in the fire door of the furnace.

TO MAKE sure that no coal gas comes out of the furnace, always keep the

chimney damper open enough to permit a slight current of air to flow into the furnace through the cracks around the fire door and the chimney damper.

Coke as a fuel for domestic furnaces resembles hard coal in many ways and the home owner who knows how to handle hard coal will have no difficulty in burning coke.

Coke is what is left of soft coal after the volatile matter has been roasted out to make gas. The residue is nearly pure carbon in a light, porous form. It burns about twice as freely as anthracite. When burning coke, you can keep the draft door shut practically all the time. The fire door damper should be shut, too, since the gas-free nature of coke means that no air need be added above the fire to obtain satisfactory combustion. Coke weighs only about half as much for same volume as hard or soft coal, so you must not be sparing of this fuel when you bank the fire at night. Otherwise you may find the fire completely burned out by morning. Put on all the coke you can.

SO THE home owner in a section where anthracite is the regular fuel need have no reason to become panic-stricken over the prospect of a shortage in his favorite form of coal. If there happens to be a strike in the hard-coal mining industry, he can turn to soft coal or coke, keep his home warm, and at the same time cut his coal bill nearly in two!

There is just about as much heat in a ton of soft coal as there is in a ton of anthracite and with a little intelligent study of the simple rules for burning soft coal efficiently, you will find that soft coal makes a very satisfactory fuel. Really, the only disadvantage of soft coal is that it requires more attention and it produces a relatively large amount of smoke. That is the only reason that soft coal is not popular where hard coal can be procured.

A Daily Schedule for the Operation of Your Furnace

BITUMINOUS OR SOFT COAL

Before breakfast:

Open chimney damper. Shake well, using slice bar to remove clinkers and stir up fire. Add a small amount of coal. Leave fire door open. Ash-pit draft should be open.

After breakfast:

Add more coal. Leave fire door open. Adjust ashpit draft as needed.

During the day:

Add coal at least three or four times. After each firing, the fire door should be left partly open for a short time and then closed somewhat. If coal clinkers badly, grates should be shaken or sliced at least once during the day.

At night:

Fire should be shaken down and sliced until it appears bright and clean, with a good red glow in the ashpit. Put on plenty of coal. Be sure to leave small red hot spot uncovered. Close ashpit draft, partly close chimney damper and leave fire door ajar.

ANTHRACITE OR HARD COAL

Before breakfast:

Open chimney damper. Shake fire to remove ashes. Put on fresh coal, just covering fire. Close fire door. Open ashpit draft door. Remove ashes.

After breakfast:

Add more coal, check chimney draft, close ashpit draft and regulate chimney damper.

During the day:

The smaller the coal, the more frequent the firing. With furnace coal one firing at noon should be sufficient, with another before or after dinner.

At night:

Shake until red glow can be seen in ashpit. Bank fire by using sufficient coal to cover all bright spots until top of fire is entirely black.

COKE

Before breakfast:

Open chimney damper. Do not

shake much, since a coke fire should not be disturbed any more than necessary. Shake just enough to remove ashes. Shovel on as much coke as furnace will hold, and close fire door tight. Open ashpit damper a trifle and regulate chimney damper.

After breakfast:

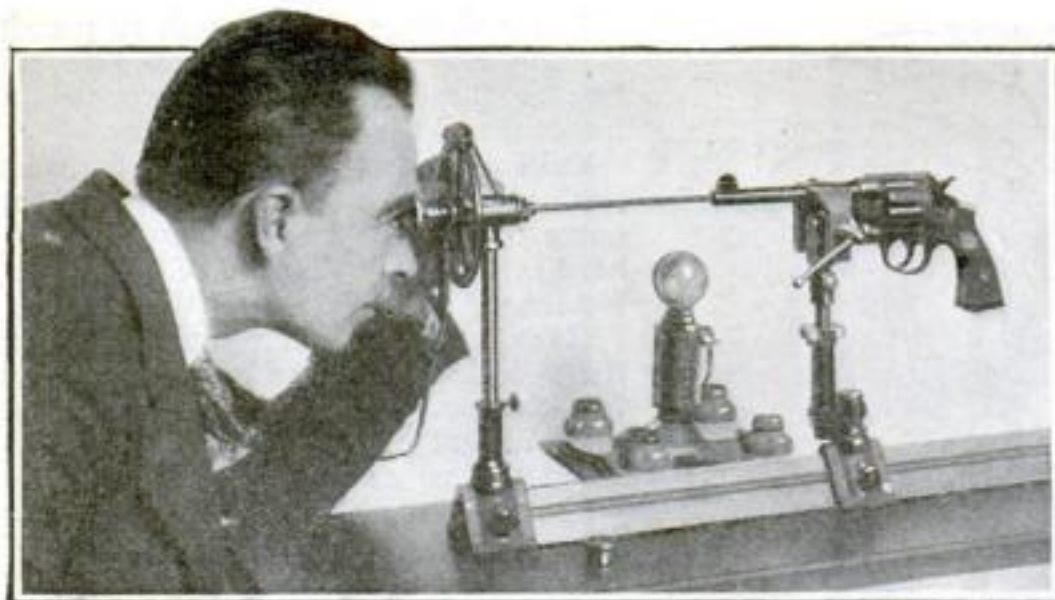
No attention needed at this time.

During the day:

Since coke burns freely, the firing should be frequent, probably as often as with soft coal. Shaking and slicing during the day should not be necessary, unless the coke is of poor grade. The heat regulation should be done entirely with the chimney damper.

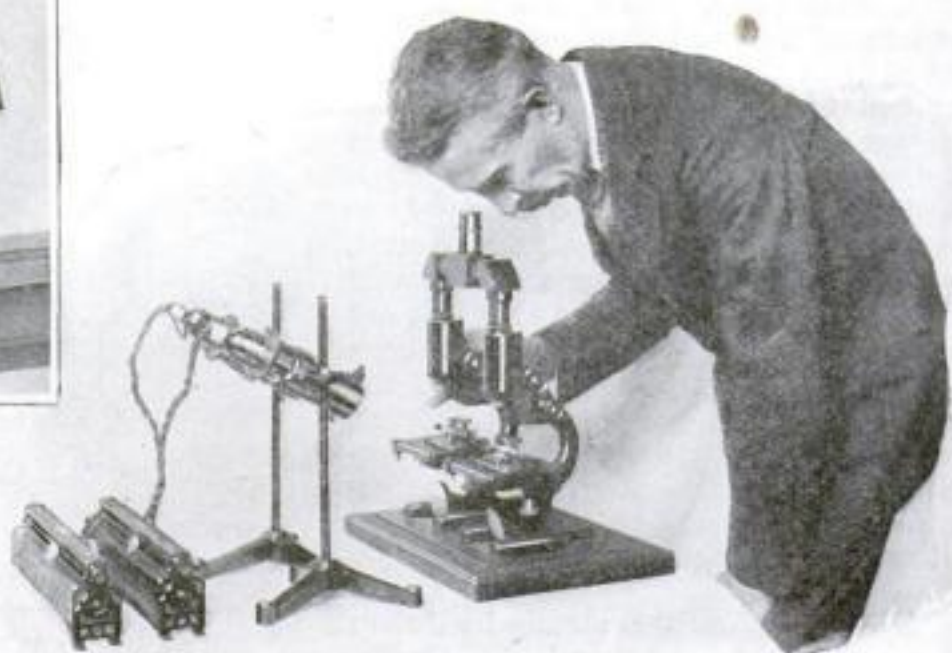
At night:

The fire should be well cleaned, since coke dies out easily and quickly. In banking, shovel in all the coke you can cram into the door. All dampers should be closed except the chimney damper. Keep that open just enough to avoid coal gas in the house.



Reading Murder Clues in Gun Barrel

Above: John H. Fisher examining the interior of the barrel of a murderer's revolver with the remarkable new instrument that makes it possible to identify flaws that might be reproduced on a bullet fired through it. Right: Philip O. Gravelle using the instrument devised for comparing the markings on a bullet taken from a murder victim with those of a bullet shot from the suspect's gun



On this and on the following page you will read of discoverers who daily are adding to the sum of human knowledge, and of their most recent contributions to the scientific progress of the world.

Every Gun Leaves Its Mark

NOT infrequently, projectiles figuring prominently in criminal cases will reveal upon their surfaces abnormalities that may have been caused by defects within the barrels through which they have passed. Such a point was at issue in the recent murder trial of Gerald Chapman, and there existed considerable difference of opinion as to the actual causative agent that had produced certain markings on bullets in evidence.

An examination of the gun barrel to settle the matter could have been adequately carried out only by sawing it in two lengthwise, and thus destroying its value as evidence. Future questions of this kind are not to be left unanswered, however, for a group of New York arms experts—Charles E. Waite, Major Calvin H. Goddard, Philip O. Gravelle and John H. Fisher—were even then working upon an apparatus that solves the difficulty without the least injury to the arm.

The problem before them was to devise a mechanism that would illuminate any desired area of a pistol barrel from .22 caliber upward, and at the same time permit a clear view of the field under examination. A modification of a surgical cystoscope and a graduated circle with vernier attachment added was finally evolved and fulfilled all requirements. Recently they completed this remarkable instrument called a "helixometer," which makes it possible to examine through a microscope every portion of the inside of a revolver or rifle barrel.

Through long researches Waite has established the fact that no two rifled revolver barrels ever are exactly alike. Although made with exactly the same tools, the minute grooves and elevations made in the rifling of the two barrels will, according to Mr. Waite, always mark the bullets fired from the

barrels in such a way that his machine always can identify them beyond question.

In the picture at the top of the page, Fisher is at work examining the interior of a murderer's revolver barrel. At the end of the tube inserted in the barrel is a tiny lens and a microscopically small electric light bulb. With this instrument it is possible to examine the interior of the barrel for flaws that might be reproduced on a bullet fired through it, such as actual defects in the metal, rust patches, lead or other metallic fouling, and to note the effect upon them of repeated firing, cleaning, or other procedures. In addition, it is possible to measure the twist of the rifling most

accurately. Since no two manufacturers use exactly the same twist, this measurement is important in establishing the source from which the weapon was obtained.

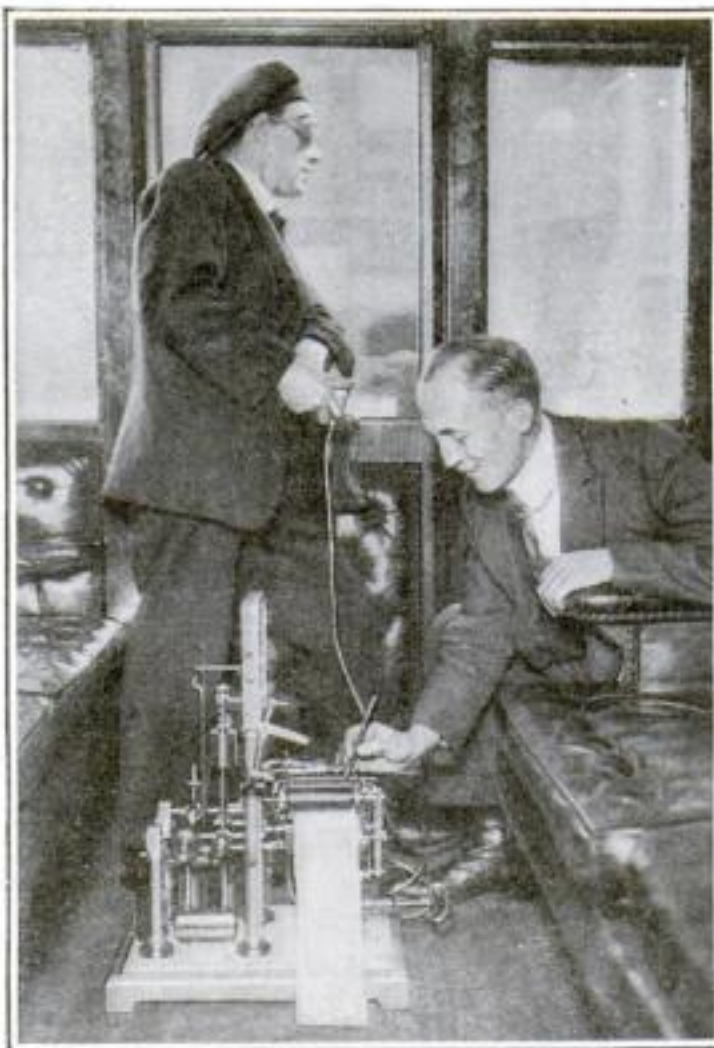
In the right hand illustration above Gravelle is seen using the second of the remarkable instruments. This consists, essentially, of two complete microscopes connected by a prismatic arrangement so that the two images can be made to overlap. A bullet taken from a murder victim is mounted beneath one microscope and a sample bullet shot from the suspected gun is mounted beneath the other. Strong light is thrown on both bullets in such a way that the infinitely small scratches and grooves produced by minute irregularities within the barrels are brought into prominent relief. By turning both bullets carefully, it is possible to compare the markings on one bullet with those on the other, and if it is found that they correspond exactly, doubt as to whether the mortal bullet came from the suspect's gun is entirely dispelled.

Cheap Fuel from Dust

IF YOU pump cornstarch with air into an inclosed tube and ignite the mixture with an electric spark, it will explode. Recent government experiments have shown in dust great explosive energy going to waste. It is this that is utilized in a new fuel announced recently.

Fuel made from dust or scourings, not only will make use of waste material, but will reduce a big potential fire hazard in manufacturing plants, explains W. A. Noel, an engineer of the Bureau of Chemistry of the Department of Agriculture. It would solve the problem of cheap fuel for factories, he adds, for it may be used in steam or gas engines.

Wood, metal, leathers, chemicals, cork, rubber, sugar, grain, cocoa, and cinnamon are but a few of hundreds of products from which the inflammable dust may be obtained. Probably the most powerful of all dusts is that of aluminum, while grain dusts are available in the greatest quantities.



Flaws in Railway Tracks Recorded

Defects in railroad track can be detected quickly and easily by this new clockwork registering machine. Installed in a coach, it records on a roll of paper all vibrations and jolts when the train is running at high speed. The photograph shows officials of the London Northeastern Railway of Great Britain testing track with the device

Killer by His Bullets

An Amazing Crime Detector—Other New Discoveries and Inventions

To Silence Riveting Din

THE terrific nerve-wracking din of riveting guns in the construction of steel buildings will be silenced within a few years, according to A. G. Bissell, general engineer of the Westinghouse Electric and Manufacturing Company. Arc welding will replace the rivets.

Welded joints now are used in airplanes and ships, and a few skyscrapers already have been constructed noiselessly. Only a few more steps need be taken, Bissell predicts, before the method will be recognized through the country as not only practical, but as a cheaper and better method of construction.

The workman is equipped with a fiber hood and wears glasses to protect his eyes from the glaring light. A closely woven suit, a leather apron, gauntlets and bellows-tongued shoes protect him from flying incandescent particles. He works in a welding booth inclosed on at least three sides, but with provision for enough ventilation to clear the booth of fumes.

Corsica Floating Eastward

A FRENCH officer, Commandant Helbronner of the Geodetic Service, who has been making a survey of the island of Corsica, recently made the startling announcement that it was floating away. In the last 100 years, he estimates, it has moved eastward a distance of about 33 feet, away from France, its owner.

This curious discovery would fit in with the theories of geologists who suggest that the earth's crust is shifting horizontally. A journalist in Italy suggested humorously that the people of

Corsica would rather be Italian than French, and therefore are riding toward the land of their preference.

A Substitute for Vaccination

AFTER 27 years of research, Dr. Mervyn Henry Gordon, of the Medical Research Council of Great Britain, has announced a discovery that in some circles is considered as important as the recent discovery of cancer virus. He claims to have found a way to immunize persons from smallpox and other diseases without vaccination.

Merely by sniffing through the nose a solution of dead germs properly heated, or passing through a room filled with immunizing vapor, it is said, persons will become immune to certain diseases.

Doctor Gordon worked with rabbits. Those "vaccinated" by sniffing dead virus, he reports, proved immune to cowpox, while others not so protected caught the disease.

Transparent Gold

GOLD of a lacy texture and as transparent as glass, an amazing product announced recently, makes one half believe in magic wands. How it is made is kept secret. A German chemist, Dr. Carl Muller, discovered it by chance one day as he was investigating certain

Electric Tiller to Steer Ships

The most recent improvement over the time-honored steering wheel for ships is this electric controller, which closely resembles those used on streetcars. A slight turn of the control handle by the helmsman causes the rudder to respond instantly to whatever direction is wanted

chemical rays in his laboratory in Berlin.

The new gold is described as a sieve of crystals through which light plays as through a thin veil of smoke or vapor. It is said to be 50 times as transparent as the thinnest gold leaf hitherto obtainable. Photographs may be taken through it.

The weblike structure of the new metal leaves will be of immense value in the study of atomic structure, the discoverer claims, and will lead to a number of innovations in radio, telephone, phonograph, and other appliances that require delicate membranes or conducting surfaces. So little metal is used that real gold may be used for plating instead of gold alloys, making a film that neither fades nor tarnishes.

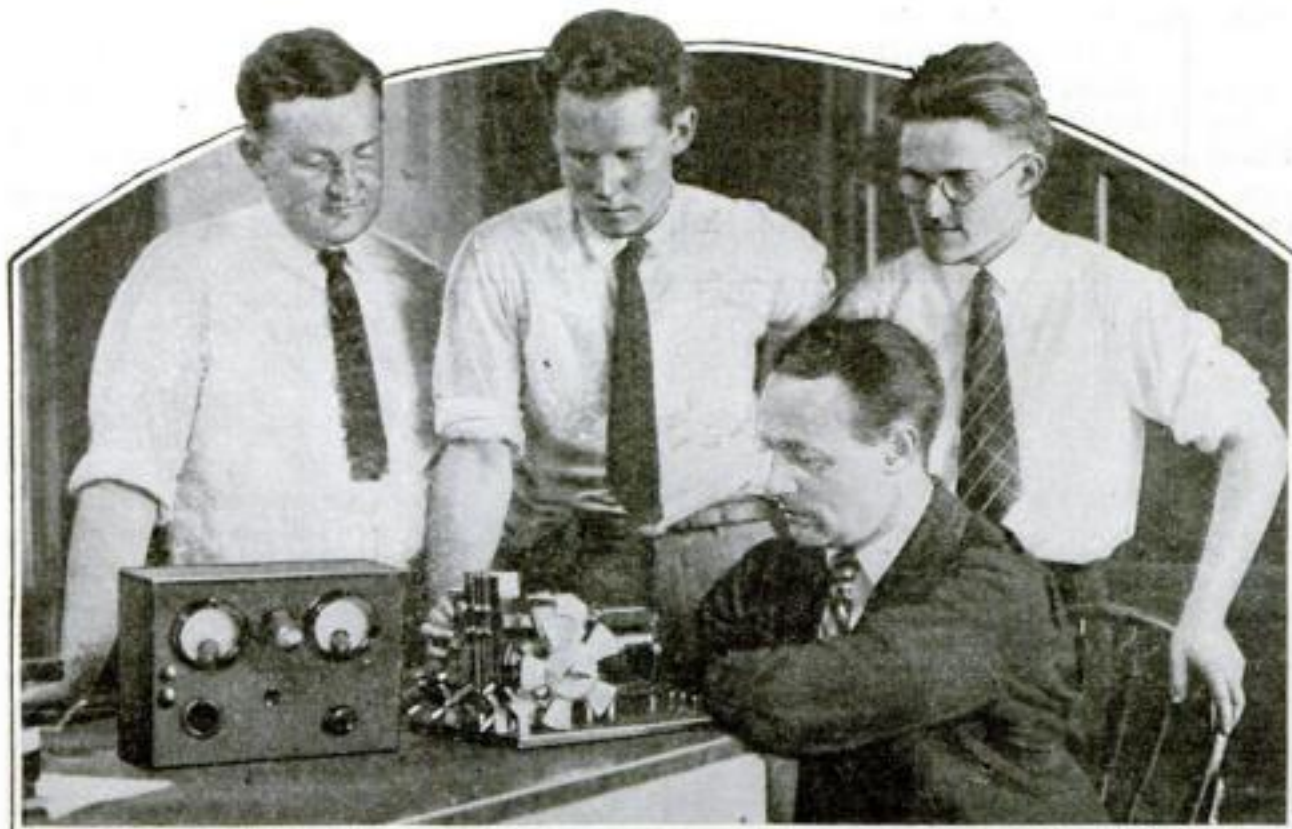
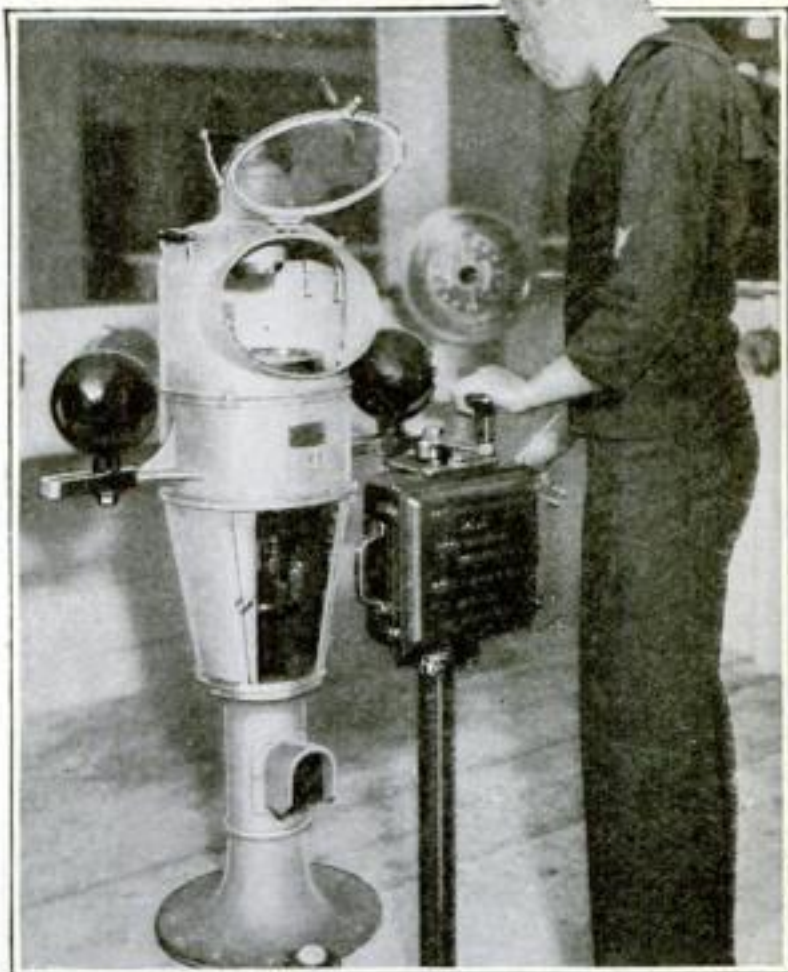
New Sources of Rubber

"HENRY, we ought to have a rubber source of our own. Foreign governments could clamp down on us any minute, and where would we be?"

"You're right, Harvey. Why couldn't we get hold of some land and produce some rubber ourselves?"

Some such conversation as this may have been the beginning of the huge project announced recently for supplying the United States with rubber. Harvey Firestone has completed arrangements for a 99-year lease on a million acres of land in Liberia, Africa, suitable for rubber production, and a plantation of 2000 acres of fully matured plants. He also took a lease on 35,000 acres of land in Mexico.

Then with his friend Henry Ford he quietly acquired huge tracts of land in the Everglades section of Florida and planted many varieties of rubber trees.

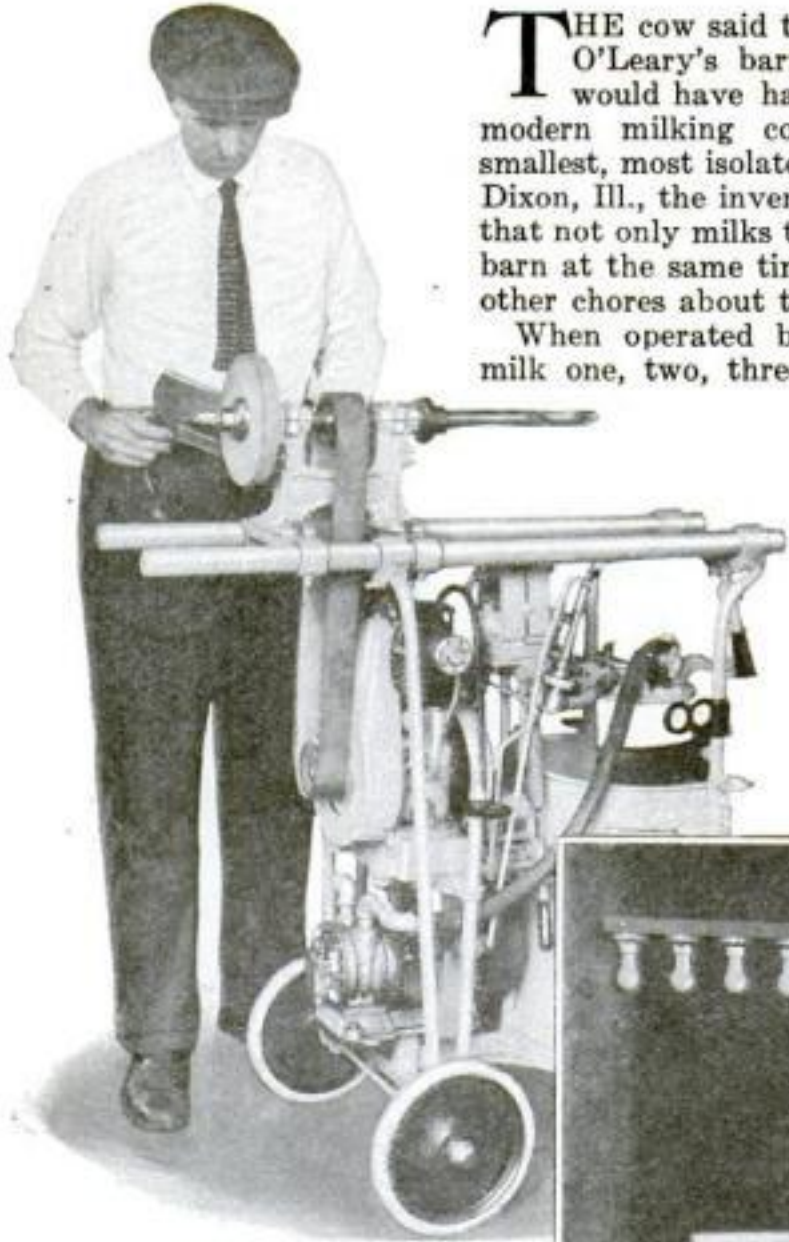


He Sends Eight Radio Messages at Once

The remarkable achievement of sending eight code messages simultaneously from a single radio transmitting tube, all on the same wave length, and of receiving them all on a single

receiving set, was demonstrated recently by John Hays Hammond, Jr., noted inventor. The picture shows him with his staff of assistants at Gloucester, Mass., operating the instruments

Mechanical Farm Hand Milks Cows



A Machine of All Work

Above: Using the portable power machine to grind tools. Note grinding wheel and attachments driven by belt from motor. Right: While milking the cows the machine also lights the barn, supplying current for 10 lamps

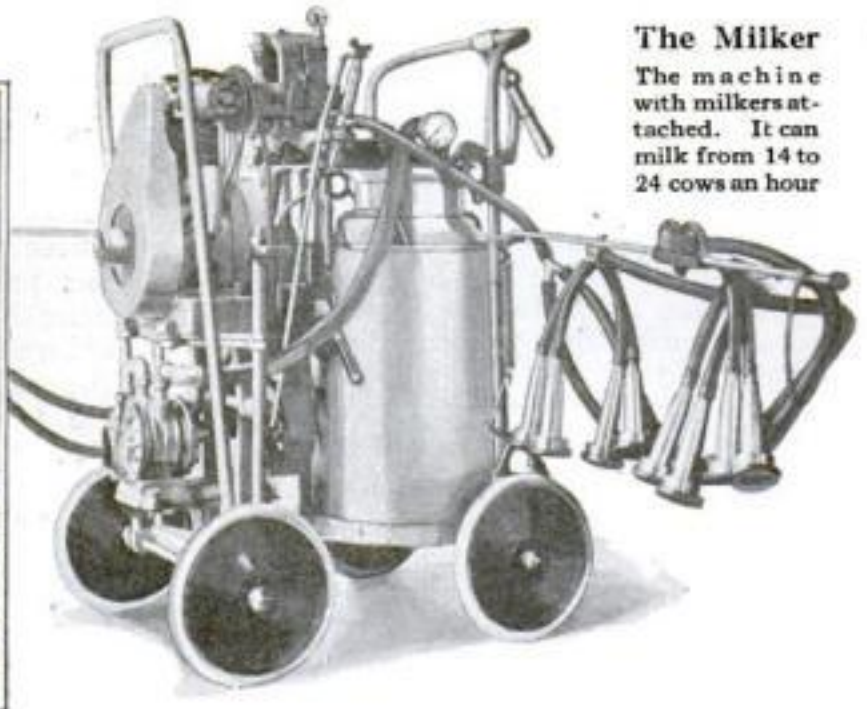
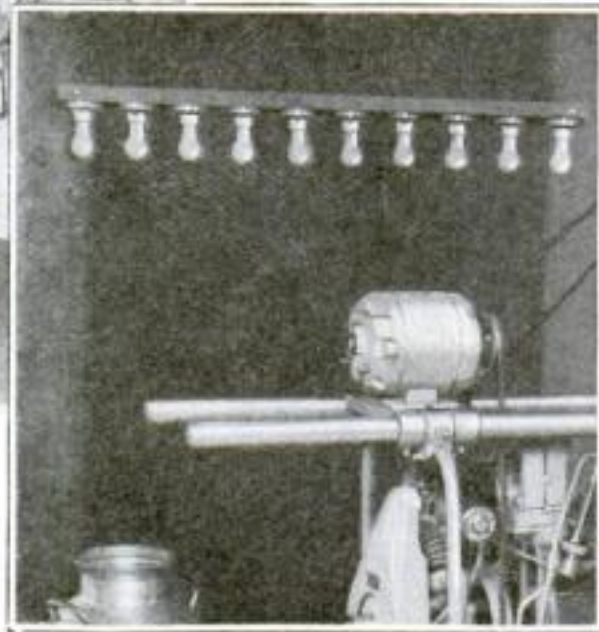
THE cow said to have kicked the lantern in Mrs. O'Leary's barn, starting the great Chicago fire, would have had no such opportunity under the modern milking conditions made possible on the smallest, most isolated farm by Warren A. Shippert, of Dixon, Ill., the inventor of a portable milking machine that not only milks the cows, but electrically lights the barn at the same time. It also does a dozen and one other chores about the farm.

When operated by hand, Shippert's machine can milk one, two, three, or four cows. By means of a partial vacuum it sucks the milk like a calf. It can be taken anywhere on two wheels like a hand truck. To this hand machine add two wheels, power, and power transmission, and it becomes a power machine operated either by a three-fourths horsepower gasoline engine or by an electric

motor. It then milks from 14 to 24 cows in one hour.

Either arrangement, hand or motor, uses an ordinary shipping can sealed from air and dust. Running a pump exhausts the air in the can. A gage registers the vacuum, a relief valve controls it, and pulsators alternate vacuum and relief.

Among other chores, the power machine can be used to run the cream separator, pump water from the well for the stock, churn butter, run the grain grinder, drive the grinding wheel for sharpening tools, run the fanning mill, corn sheller, or sausage grinder. The farmer's wife also can use it as a vacuum cleaner to sweep out the house and to supply power for the electrical household appliances. Even after the day's work is completed it is useful in lighting the living-rooms of the farm and in charging the radio battery overnight.



The Milker

The machine with milkers attached. It can milk from 14 to 24 cows an hour

Paper, Boards, and Boxes from Waste Lumber

NEW uses found for shorts and scraps—the ordinary waste from lumber—promise to save thousands of dollars in the lumber industry. Recent experiments in Cloquet, Minn., a little town of forest-fire fame, have found value even in branches and tops of trees—everything down to three inches in thickness. Mills now burning lumber waste under their boilers, it is predicted, soon will look for less valuable fuel.

Three new ways have been found to utilize waste formerly considered not worth hauling away from the forests. These are the manufacture of a new kind of paper, balsam wool, and artificial boards.

The triumph in paper making was the discovery that poplar and jack pine, thought unsuitable for this purpose, could be used for making bond and other grades of paper. Both kinds of

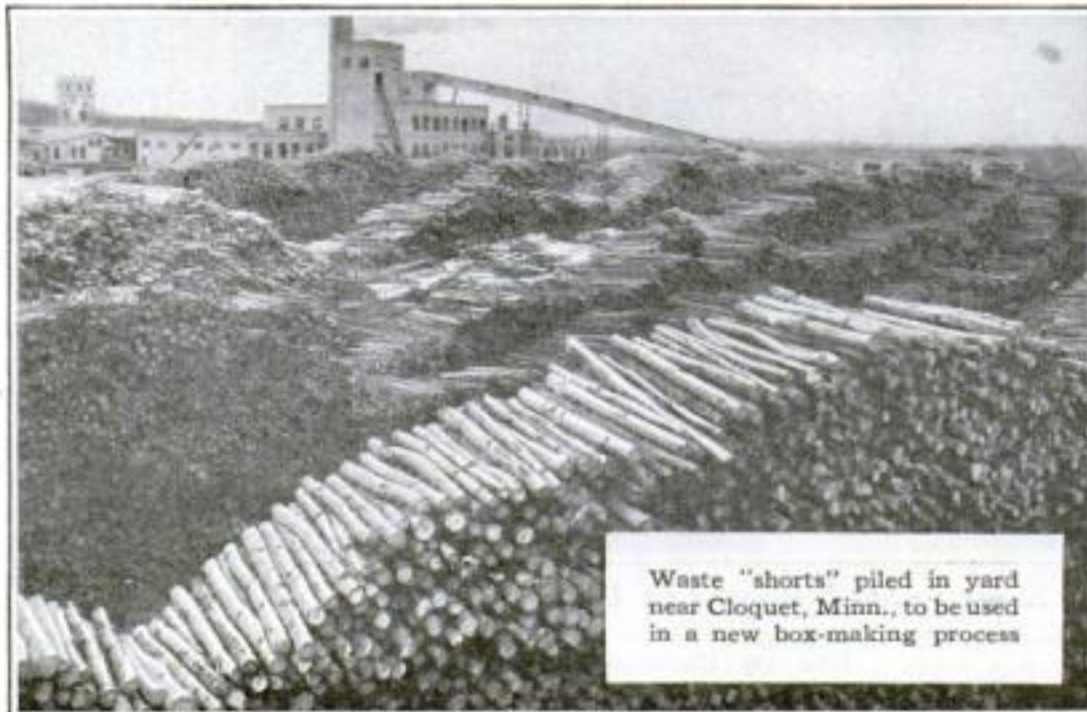
trees have a natural reproduction, and a simple forestry scheme, it is claimed, will insure a perpetual supply of raw material for paper mills.

The leftovers from the paper mill in Cloquet are used to make balsam wool, a new fire-resistant insulating material. It can be applied to houses, iceboxes, fireless

cookers, refrigerator cars, and many other purposes.

When wood fiber is passed through the screen of a paper mill, a certain knotty substance, known as "rough screenings," will not go through. This mass of fiber, when used in the manufacture of balsam wool, is put through a sulphite process, fireproofed and ground. It is treated to give it adhesion, and finally is brought out in the form of a sheet of light insulating board.

Box factories, having discovered a way to cut tongue and grooves on small boards, now are turning to use many boards of sizes too small for piling in lumber yards, that is, material three inches in width or under, and from 12 to 47 inches in length. The boards are glued together to make boxes. A box factory in Cloquet now is using 11,000,000 feet of such shorts.



Waste "shorts" piled in yard near Cloquet, Minn., to be used in a new box-making process

Boys Build Scenic Railway of Boards

Three Rides for a Cent—Switches, Too

THE Gang was sitting on the steps of Jack Streeter's front porch in Newark, N. J. Summer amusement parks were under discussion. It was a sort of post mortem, for school had begun and trips to the amusement parks would be few and far between. Next summer was ages away.

Most of the gang had gone home to supper. Abe Haman and Wilbur Drikson were still at Jack's house when a brilliant idea struck them. Why not build a scenic railway? They could even charge for rides. Make money. A real business proposition.

The three formed a closed corporation, so to speak, and operations began. They found a wonderful site—a vacant lot with a slope that would make the cars go lickety-split. There were lumber piles around and with judicious explaining maybe you could get planks for nothing.

The boys put supports in the ground and on these laid a track of boards. They fitted the system with switches



Above: Collecting fares for rides on the homemade scenic railway—three rides for a cent. Left: Heavy traffic on the line. The monorail track was made of old lumber. Notice the switches and cross-over

so the passengers could go over different routes. The cars were made like sleds with wood blocks for runners that fitted on each side of a guide rail in the center of the track. Each car held two passengers. A braking system also was figured out by these ingenious boys.

One cent for three rides was the charge the inventors decided upon. From the first their railway proved profitable. And popular? Jack, Abe, and Wilbur are the most popular boys in the neighborhood—for the management, you know, sometimes hands out passes.

Model American Home Is Shipped to France

"HOUSES of painted wood? How strange!" or "No servants? How do you manage?" These are typical remarks of Frenchwomen when American women tell them something of their homes in the United States. Soon they will have a chance to see just what a modern American house looks like.

A 10-room house, considered representative of the typical American home, was erected recently in Brooklyn, N. Y. Then it was dismantled completely and placed on a ship with its furnishings and equip-

ment to be taken to France for exhibition in February at the American Section of the International Exhibition of Household Appliances and Labor-Saving Devices.

The two-story shingle house maintains the Colonial atmosphere throughout. The furnishings and decorations are all authentic copies from period pieces. Comfort and livableness in the interior are emphasized. The house is equipped with running hot and cold water, electric lights, gas service, and has every device that modern inventive ingenuity has

provided to chase drudgery from the home.

When they all see the rebuilt home, Frenchwomen will be astonished by the amount of household work that can be done by pressing a button. For vacuum cleaners, washing machines, drying machines, electric irons, cookers, and refrigerators are unknown to most Frenchwomen.

After the International Exhibition is closed the American Home is to be given to the French citizen who has made the greatest contribution to humanity in recent years.



Maxime Mongendre, French Consul General in New York (left), receiving from Arthur Williams, Vice-President of the New York Edison Company, the keys to the Model American home



The model 10-room house as it appeared in Brooklyn, N. Y., before shipment to the Paris International Exhibition. It is of the Colonial style and is fitted with all the most modern electrical appliances, conveniences, and comforts

Auto Carries Wire Cutter to Foil Bandits



A German motor car with the sawlike wire-cutting attachment

A WIRE is stretched across a lonely country road. The car must stop. Highwaymen leap from the brush on either side, and another hold-up is perpetrated.

So frequent has become the use of wires in robberies in Germany that a novel sawlike wire cutter has been devised. Attached to the front of an automobile, it is said to be successful in cutting the strongest strand.



Curious Pipe Devised for a Clean, Sweet Smoke

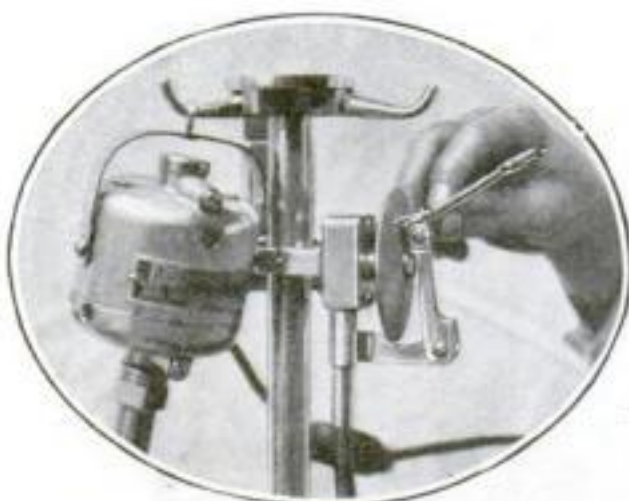
FROM the land of pipes comes another ingenious idea to keep your smoke clean and cool. A British inventor has made a new pipe with a trap for nicotine. The pipe stem is elongated, running past the bottom of the bowl. Fitting to this is a small metal tube perforated at the bottom and covered with a wooden tube.

A tubular chamber screws into the bottom of the wooden tube and into this chamber flows all the nicotine and saliva. Because it is kept so far away from the pipe bowl, the nicotine, it is claimed, cannot be drawn into the mouth, for it would have to traverse the length of the small metal tube and be drawn through the small perforations.

A Keyboard for Kettle Drums Plays Eight of Them

IN SPITE of his amazing dexterity, the kettle-drum player in an orchestra needs even more agility to play all that is demanded of him in modern music scores. Professor Schneller, a noted kettle-drum player of the Vienna Philharmonic Orchestra, is coming to his rescue with a kettle-drum piano that will operate eight drums of varying pitch.

Even the most modern orchestras have at most four kettle drums. With a piano keyboard arrangement, the work of the drummer, it is claimed, would be lessened greatly. But would not the admiration of the audience also disappear?



Electric Shears Sharpener

DRIVEN by a small electric motor, this new sharpening machine for barber shops will, it is claimed, sharpen a pair of shears in one minute. An adjustable gage holds the edge of the shears against a convex carborundum wheel at the part of the wheel that will assure the correct bevel.

Know Your Car

THE spark plugs in your automobile have but one function—they provide a small gap between two metal surfaces or wires so that the high voltage current generated in the spark coil may jump the gap and, in so doing, heat the gasoline and air mixture so that it will ignite. One of the wires forming the gap must be insulated completely, otherwise the current would take an easier path than that across the gap.

To keep your spark plugs on the job, follow these rules:

1. Be careful not to strike the plugs with a wrench when you are working on the engine. A slight jar may start a crack in the porcelain that will, later on, short circuit the plug.

2. Never screw a cold plug tightly into a hot engine. Wait till the plug has become warm before you give it the final twist with the wrench. Otherwise the plug may set so tightly that you will have trouble getting it out.

3. Always clean your plugs when the porcelain core begins to show black from carbon deposits.

4. Never use a sharp knife to scrape off the carbon. You may scratch through the glazed surface of the porcelain and the rough places will collect carbon very rapidly.

5. See that the gap is set about the thickness of a worn dime.

Taking a Sawmill into the Forest

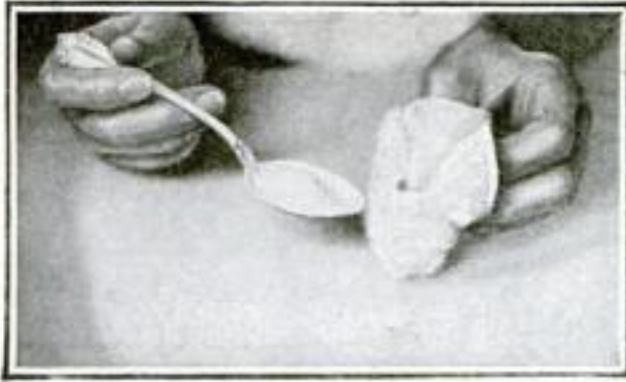
DISPROPORTIONATE to its size is the power of this unique plane saw used in the forests of France to topple towering giants. One of its most interesting features is its portability, which makes it possible literally to carry the sawmill directly into the forest.

The cutting is done with a chain of saw teeth. When felling trees, this chain passes around the trunk in a horizontal plane. For cutting the trunks into short lengths later, the chain is used in a vertical plane. A small motor runs the saw. The chain is made up of separate links, so that if damaged, a section of the chain could be removed quickly and replaced.

VACCINATING for rheumatism is announced from Vienna, Austria, where Dr. Gustav Paul, director of the National Vaccination Institute, claims positive cures in 600 cases.



Felling a tree by motor power with the portable plane saw



Newest Powder Puff Can Be Cleaned Easily

YOU use a spoon to fill this new powder puff. Once filled, the slot through which the powder has been poured is closed so that the puff will not leak.

When the puff is patted, the powder comes out of small perforations in the wool. The chief advantage claimed for this beauty aid, besides being a powder container, is that it has a back of rubber and the wool powdering surface may be washed very easily.

Pests Invade Pine Forests

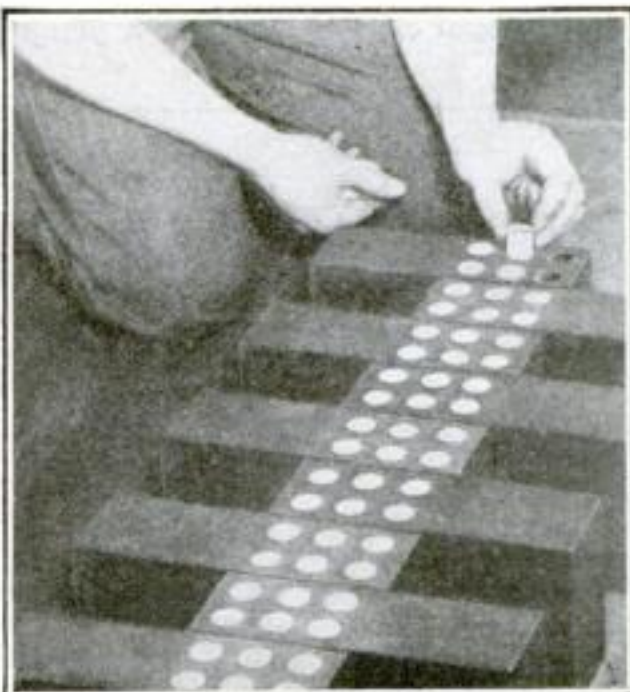
IN THE last few years tens of thousands of American trees—enough to build thousands of homes—have been destroyed through the invasion of the great Pacific forests by the pine beetle, an insect that in less than one year can ruin the mightiest pine tree.

Evidence recently submitted to the U. S. Senate Committee on Public Lands showed that in a single section of 1,000,000 acres in Klamath County, Ore., lumber destroyed by the pests would have been enough to build not less than 8000 American residences of an average cost of \$12,500 each.

White Traffic Lines Made with Porcelain Studs

A NEW idea for making permanent white lines for use at street crossings and for the direction of motor traffic is to be tried out soon in London. White porcelain studs are inserted in holes drilled in wood paving.

The studs are inserted in a line three abreast, making a strip of white wide enough to be seen easily. The chief advantage of the porcelain is that it is unaffected by weather, oil, or mud, and thus makes a line that cannot be erased by the constant beat of traffic.

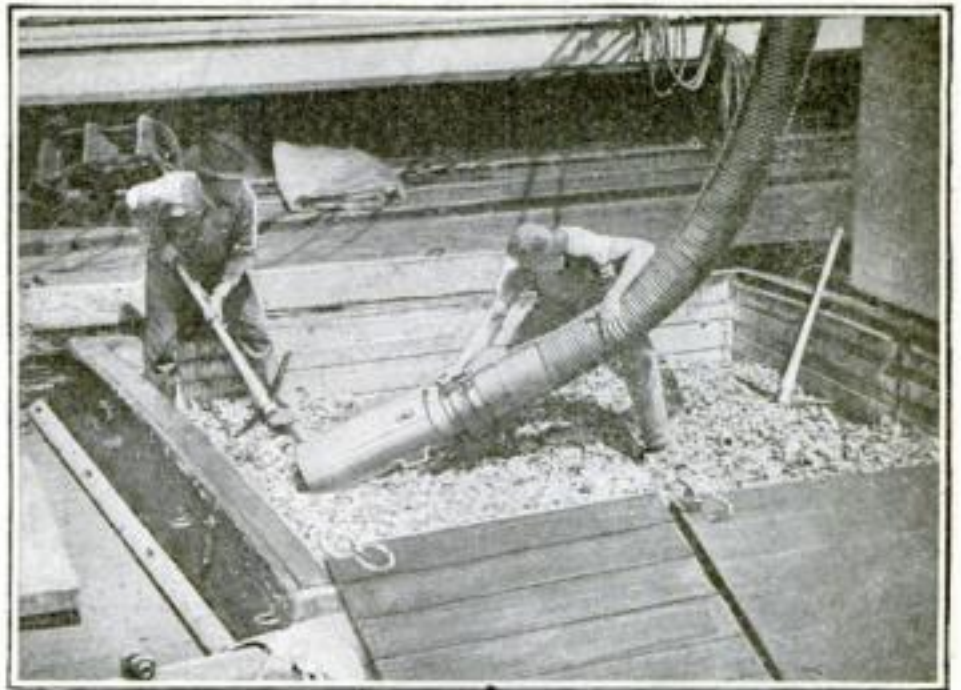


How the porcelain studs are inserted

Huge "Vacuum Cleaner" Now Unloads Cargoes

FROM the South Sea Islands every year hundreds of tons of copra—dried meat of coconuts—are unloaded at the San Francisco docks. A giant "vacuum cleaner," recently installed, now does the work of unloading, taking the place of a crew of 25 laborers.

It unloads from 30 to 40 tons an hour. With it three men can do the entire job.



Using a vacuum machine to unload a cargo of copra



Six Pocket Tools Combined in This Cigar Cutter

ONE more curve, one more use. Inventors get real fun out of figuring how, with a few extra edges and odd projections they can give a bit of metal a large number of uses.

The device illustrated above is a six-in-one pocket tool. In the photograph it is being used as a cigar cutter, but it is equally effective, it is claimed, as a bottle opener, screwdriver caliper, wire cutter, or key ring.

Metallic Substitute for Diamond

AFTER several years of research, metallurgical experts of a steel plant at Wetzlar, in southern Germany, claim to have produced a metal alloy nearly as hard as the diamond. The difference in the scale of hardness is merely one-tenth of a degree. The alloy consists of a fused mixture of metallic tungsten and tungsten carbides.

Tests have shown that this tungsten alloy, while somewhat softer than diamond, offers many practical advantages. It is said to have metallic structure and to retain its cutting power much longer than the diamond that has crystalline structure and is extremely brittle, hence soon loses its cutting power by the chipping of its crystal edges.

Criminals Change Their Faces by Plastic Surgery

THROUGH the clever capture in Vermont of a burglar who had his facial appearance altered by surgery, attention was called recently to the increasing use of plastic surgery by criminals seeking to escape identification. On the prisoner was found a receipt for \$450 paid to a New York surgeon for changing the contours of his ears, chin, and nose. He had dyed his hair, too.

How Much Do YOU Know about Science?

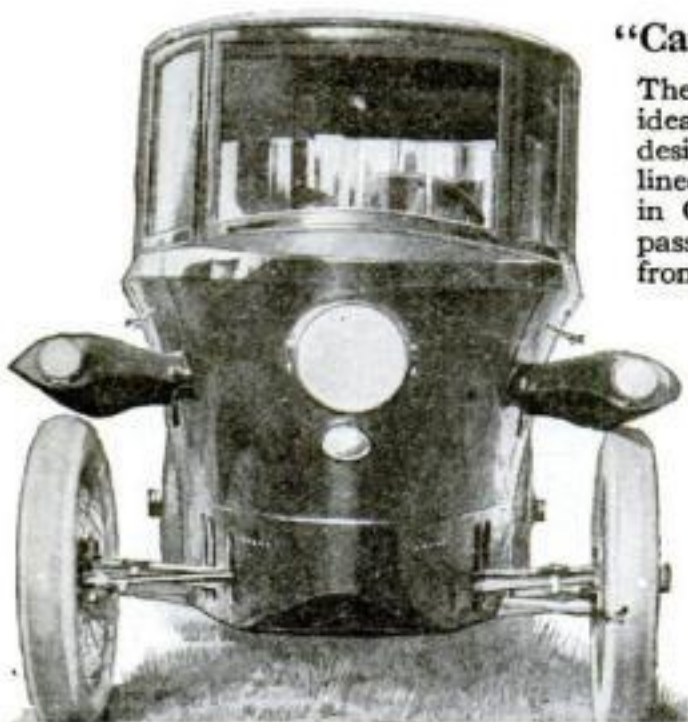
THE following 12 questions were selected from hundreds of queries that come from POPULAR SCIENCE MONTHLY readers every month. Read them over and see how many of them you can answer. Although the questions have to do with things that we encounter every day, they involve a surprising number of new and interesting facts about the world we live in.

Here's a chance to test your knowledge. After you have answered the questions to the best of your ability, turn to page 150 and see how nearly you were right.

1. When do children grow fastest?
2. Why do onions make our eyes water?
3. How were precious stones formed in the earth?
4. Why does a gun make a bang when it goes off?
5. What is the carrier wave?
6. Why does frost kill a plant?
7. What is dynamite made of?
8. Why do cats ruffle their hair?
9. Is there any place where things weigh nothing?
10. Why does the earth revolve?
11. What was the first animal to live on dry land?
12. Why is it difficult to walk in a straight line when your eyes are closed?

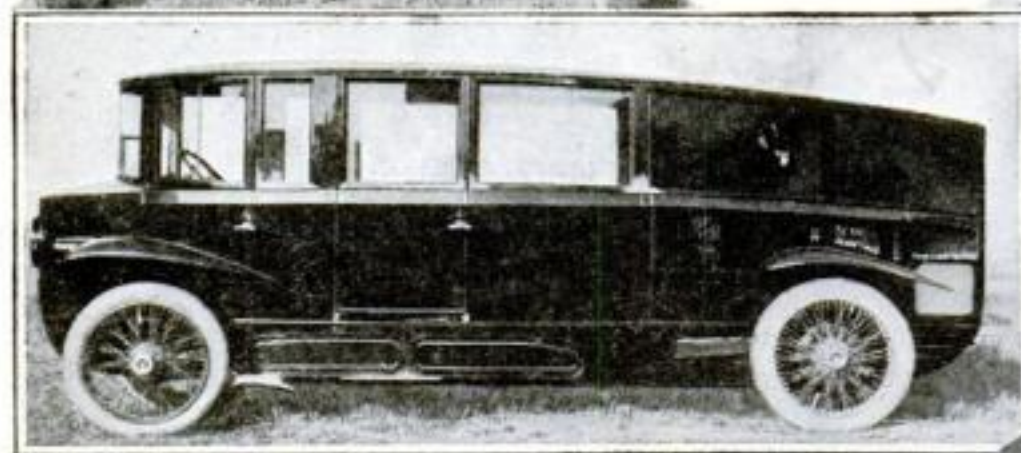
Oddities on Wheels

*Some Remarkable Developments
in Light Cars and Heavy Buses*



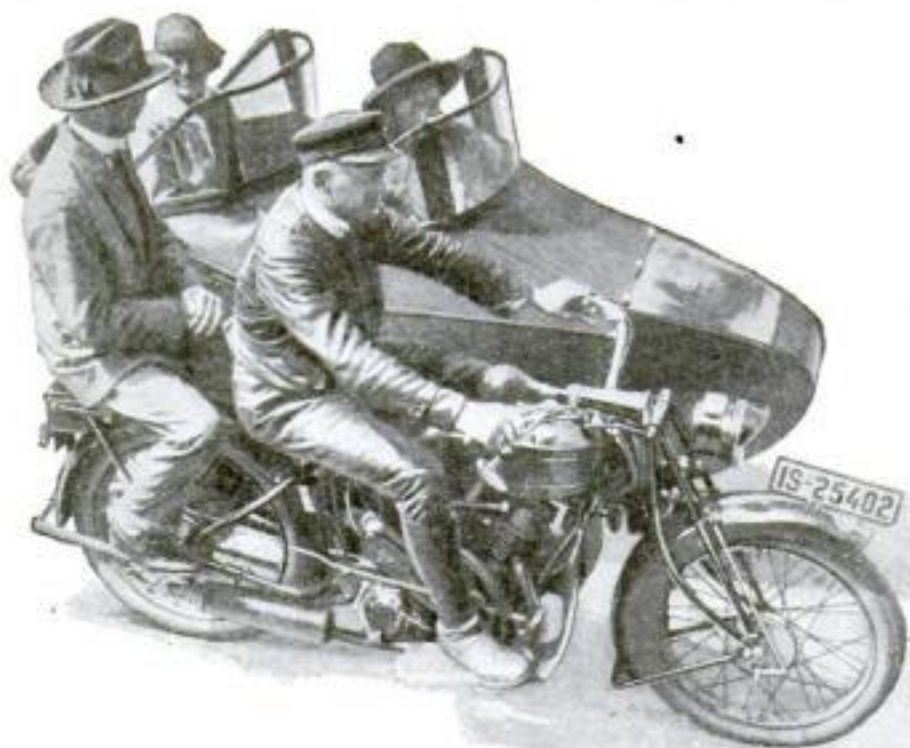
"Cart before the Horse"

The "cart before the horse" idea has been applied in the design of a novel streamlined passenger car developed in Germany. Seats for the passengers are placed in front, while the engine is carried at the rear, as shown in the side view below. The boatlike body has a sharply pointed prow, pictured at left, to cut the wind



Tricycle for Two

For the young couple not too particular about comfort, there recently has been developed this light three-wheeled cycle car. The streamlined body is constructed of aluminum



Fire Apparatus Carried on Sidecar

A sidecar fire engine carrying complete fire fighting equipment was a novel exhibit at a recent motorcycle show in London. This compact apparatus was designed for use in rural districts and for fighting forest fires. The equipment includes chemical extinguishers and a pump

Two in Sidecar Tandem

This four-passenger motorcycle carries two in the sidecar. Each of the sidecar seats is fitted with a windshield and separate door for entry. The car is streamlined, as illustrated

Eight-Wheel Passenger Bus

A recent remarkable development in overland passenger buses is the huge eight-wheel gas-electric coach pictured at right. It is driven by a 110-horsepower engine with electric transmission. An ingenious steering mechanism makes it possible for the huge vehicle, 38 feet long, to turn around almost in its length



Queer Boats *and* Their Skippers

A Sea-Going Bicycle—Novel Man-Driven Propellers—A Powerful Hydro-Glider



A Water Bike

Antonio Moreno, movie star, was making a picture on the Riviera, when he became interested in a new sport called "water cycling." The photograph shows him riding the novel machine, a bicycle frame mounted on two pontoons. The pedals drive a paddle wheel at the stern.



No oars needed in this boat. That's why James Marvelle, of Wareham, Mass., built it. Marvelle stands in the bow and pushes a lever that drives the paddle wheel, leaving one hand free for fishing.



Stormy Trip in 20-Foot Boats

Frank J. Coyle and Fred S. Dale, engineers, left New York for Florida a short time ago in 20-foot duck boats—the smallest craft ever to undertake such a voyage. Each boat was equipped with oars and a sail. In their venture, Coyle and Dale undertook a feat that many believed to be impossible in the winter.



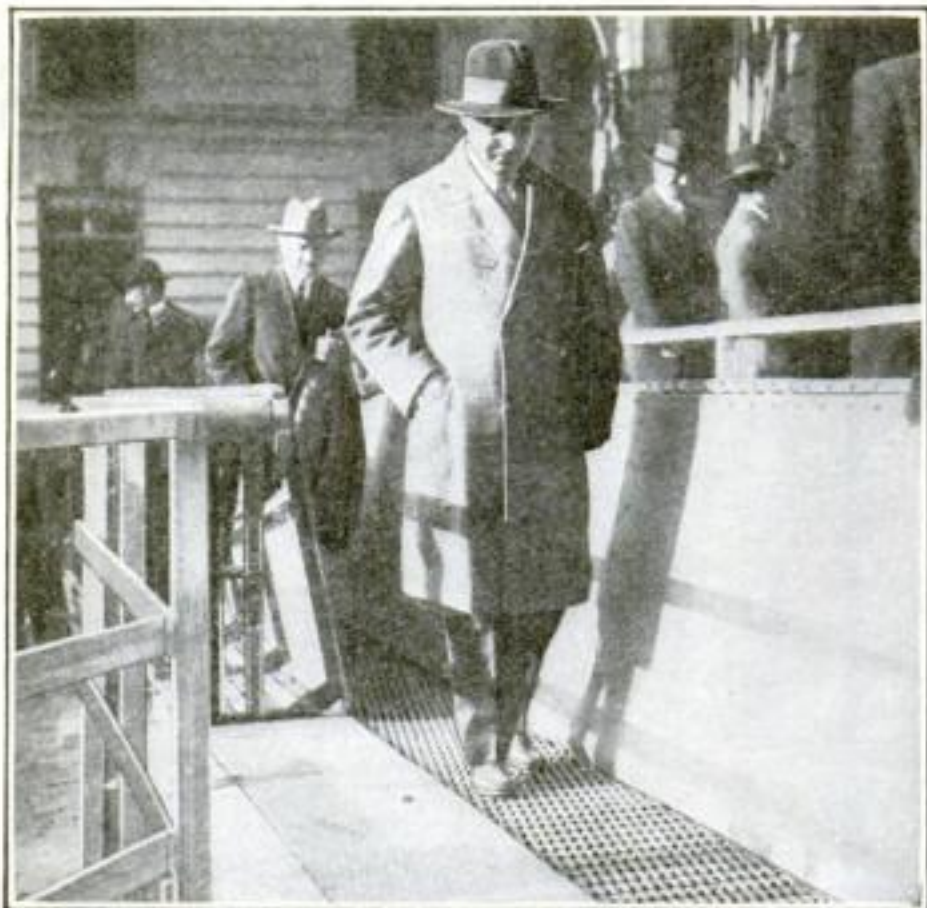
Hydro-Glider Built for Belgian Congo

Built especially for the shallow waters of equatorial Africa, this compact hydro-glider can carry freight and six passengers at a speed of 20 miles an hour. Driven by a 200-horsepower motor, it furnishes striking contrast to the various types of primitive native craft it passes every day.



Canoe Propelled by Feet

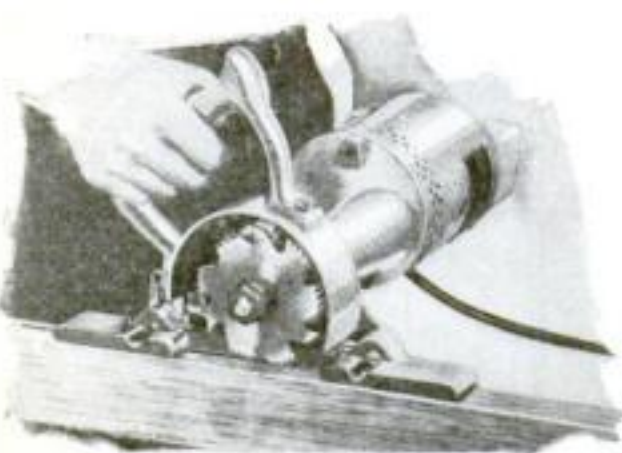
In Birmingham, England, T. Allen, an engineer, designed this bicycle canoe. The operator lies at the back and pedals. Allen is shown taking his wife on a trial trip.



Paris Tries Moving Sidewalks

LIKE all the great cities of the world, Paris is faced with the problem of traffic congestion in its chief thoroughfares. Not long ago a test was made of elevated moving sidewalks and now the city fathers have decided to install them at busy street crossings.

The sidewalk is wide enough to accommodate only one person. It is corrugated, somewhat as an escalator is, to avoid pedestrians' slipping in wet or in freezing weather.



Electric Groover Aids when Installing Weather Strip

A NEW portable electric tool for cutting grooves in wood was designed especially for installing metal weather strips. Only two adjustments are necessary, one for the depth and the other for the location of the groove, after which guides keep the tool in position.

The motor will operate on either alternating or direct current and may be attached to an ordinary electric-light socket. There is a switch in the tool's handle so that the current can be turned on or off without its being necessary for the operator to change his grip.

AN ITALIAN zoologist, Dr. Filippo Silvestri, went to the Orient in search of parasites to combat the Oriental red scale that has ravaged the orange-groves of California. He discovered three kinds of insects that feed upon the pest, and is shipping them here by the thousand.

Percolator Gives Fresh Coffee for Every Customer



This huge percolator makes from three to 21 separate cups of coffee at one time

"CHIEF engineer" would seem a more appropriate title than "chef" for the man who operates the intricate looking piece of machinery illustrated. But it is only a coffee percolator of the latest model for restaurant use and, in spite of its many levers and attachments, it is said to be very simple in operation.

It makes from three to 21 cups of coffee at a time, each order made separately. Warmed-over coffee has no place in the up-to-date restaurant.

House of Logs and Concrete

A CLEVER builder in St. Paul, Minn., takes advantage of the shrinking property of green wood to build warm, air-insulated houses. Wood logs cut in pieces as long as the wall is to be thick, are laid in the concrete while green. The wall is stuccoed on the outside, while the inside is furred and lathed.

The wood dries out, leaving air spaces that, besides insulating the house against heat and cold, act as a sound deadener. Where wood is plentiful, this method costs little.



How logs are set in the concrete to form an insulating wall, which is then stuccoed on the outside

Motion-Picture Outfit Weighs only Five Pounds

MANY American travelers abroad last summer brought back with them surprising little motion-picture outfits made in France for amateur photographers. Now these machines are on the market in the United States.

The camera and projector are small enough to be carried in a small handbag,

the combined weight of both machines being only about five pounds. Close-ups of objects in motion can be made at five feet, and pictures may be taken at any distance without any focus adjustment.

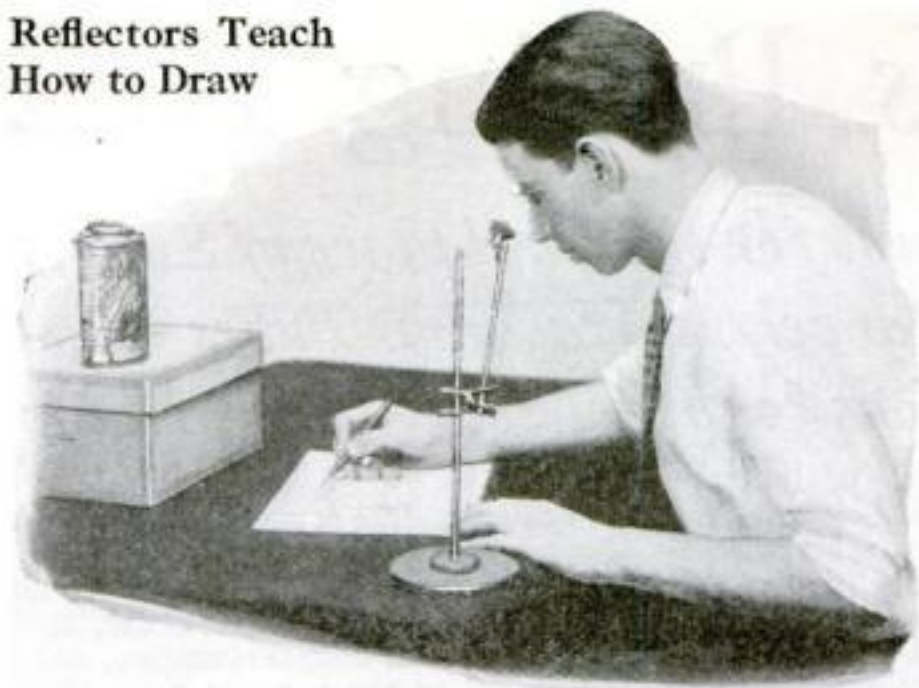
Pictures can be projected on as small an area as the human hand, it is claimed, with perfect visibility. An especially ingenious feature of the projector is an automatic stop that halts the movement of the film while subtitles are being shown. This effects a saving in film footage.



Left: Taking a picture with tiny camera. Right: Projector is very easy to operate



Reflectors Teach How to Draw



CORRECT proportion, perspective, and all the other hoodoos of the would-be artist are conquered, it is claimed, by an ingenious little assistant with double mirrors. The artist looks through the reflector and follows with pencil, pen, or brush what he sees on the paper.

By adjusting the position of the reflector the size of the finished drawing may be determined—exact size of the original, enlarged, or reduced. The instrument may be used, also, to teach penmanship. By following what he sees reflected on the paper, a child learns the proper formation of letters.

Now You Can Call up Your Friends at Sea

"HELLO, when did you leave New York? Saturday? That's the day we sailed from Hamburg. From our positions on the ship chart today, I noticed that your boat and ours are just 100 miles apart."

A scrap of conversation on board the new German liner *Berlin*, the first ship to be equipped with radio-telephone booths for the use of passengers. They are connected with the ship's radio room, where the sending and receiving apparatus is located, and are operated through a switchboard.

With this radio telephone you can talk to friends on other ships within a radius of a few hundred miles.



Phoning from an ocean liner



Styles in Industrial Gas Masks

BECOMING? Far from it. But the young women were willing to hide their faces for a few minutes in order to demonstrate the latest models in respiratory masks.

The one on the left and that in the center are dust masks for use by persons working with emery wheels and in factories where fine powder flies in the air. They are alike, except that one has a goggle attachment. The one on the right is a gas mask used in places where work is done with acids.



Ceiling drill is supported by tubing

Drill for Making Overhead Holes in Concrete Buildings

AS THE use of concrete in building grows the problem of how to drill overhead holes economically has arisen. Thousands of such holes must be drilled to hang shafting, strap electric conduit, run sprinkler lines, and fasten partitions.

A new device recently put on the market, illustrated at the left, enables an electric or pneumatic drill operated by a single workman to be used for this awkward work. The drill is clamped firmly to the upper end of a shaft made of two telescopic pieces of steel tubing. Handles controlling the drill are placed at a convenient working height on the tubing. Power control is provided by running a draw wire from the trigger switch to the handle position and a coiled spring provides the pressure needed to make the drill bite in.



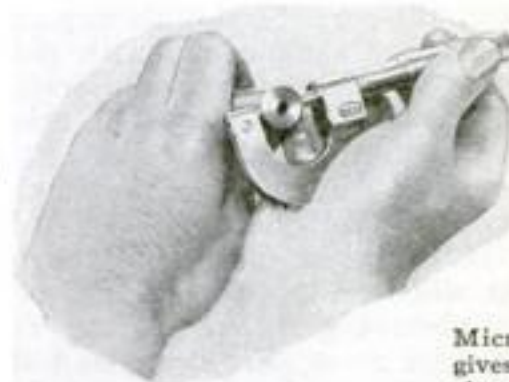
Atop an 85-Foot Fire Ladder

TO ILLUSTRATE spectacularly what could be done with a new 85-foot fire-fighting aerial ladder, it was raised to stand erect, with the fly ladder fully extended. On the extension, towering high above the truck, a nifty man climbed to the top, while the apparatus remained firm, absorbing the strain within itself.

The ladder is raised automatically and is operated on a turntable, which revolves in any direction. A screw-operated friction brake locks the turntable at any point.

Newest Micrometer Gives Its User a Direct Reading

NO MORE squinting at the fine graduation lines of a micrometer for the machinist making careful measurements. This micrometer is claimed to give readings of thousandths of an inch, in clear figures. Furthermore, it is of a

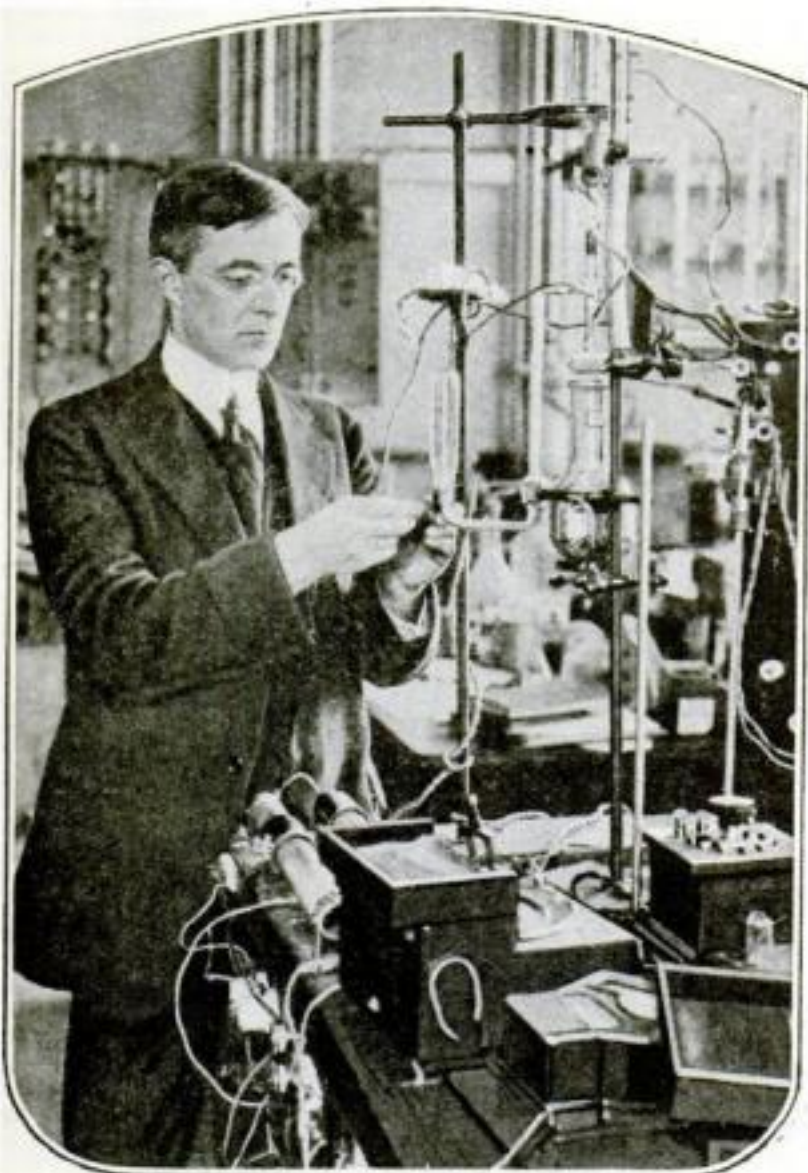


Micrometer gives its own clear reading

size that can be held and operated easily in one hand. The makers say that the dials cannot get out of order.

How Science Is Putting New

A Hunt for the Birthplace of Storms—Marvelous Vacuum Tubes—Inventions that Meet Our Needs



Wins Basic Patent on Vacuum Tube

Dr. Irving Langmuir, Assistant Director of the General Electric Research Laboratory. For his invention of the hard type of vacuum tube used extensively for radio and X-ray, his company has just been awarded a basic patent after a legal battle lasting a dozen years. It is estimated that more than 10,000,000 tubes embodying his invention are at present in operation throughout the United States.

The lure of a new discovery lies in its possibilities for useful applications. So it is that the developments of scientific progress, told in concise form on these pages, bear vitally on the happiness, comfort, and success of every man. To read about them will help you to keep well informed of the world's achievements.

A New Slant on the Weather

THE birthplace of storms—that vast frozen sheet covering Greenland's icy mountains—is the ultimate goal of an expedition of adventurers that is being organized this winter under the leadership of Prof. W. H. Hobbs of the University of Michigan, an authority on glaciers and geology.

The party expects to start for Greenland next July, equipped with airplanes for preliminary exploration, with radio apparatus to maintain communication with the outside world, and with scientific apparatus to record pranks of the weather and to observe the movements of the great Greenland glaciers.

One of the chief objects of the expedition will be the establishment of a weather observing station on the vast plateau of ice some 150 miles inland and 7000 feet above sea level. Never before has this been accomplished. At this station Professor Hobbs hopes to maintain a staff of observers for a year to give meteorologists of the world the

first accurate information concerning weather disturbances in the part of the world where severe storms are believed to gather. The observations, sent by radio to civilization, are expected to aid greatly in making accurate daily weather forecasts in the United States and Canada.

While the expedition will be under the auspices of the University of Michigan, several American governmental bureaus interested in scientific problems of the arctic regions have promised to take part.

A Marvelous Tube

A TUBE so sensitive that it rings a bell when a ring of cigarette smoke floats by, that shrieks a warning when the shadow of a burglar crosses its surface, that measures the light of stars millions of miles away—such a marvelous instrument was exhibited recently by V. K. Zworkin, a physicist in the

Westinghouse Electrical Research Laboratories.

It is a combination of a thermionic tube, one that responds to heat, and a photo-electric cell, which turns light into electricity. The tube looks about the same as an ordinary vacuum tube, but reacts to variations of light falling on it, these variations being converted into surges of electricity that can be converted

into sound. The sounds are amplified a thousand times.

The day when we shall have radio movies is brought much closer, it is claimed, by this unique invention, which is pictured on the opposite page. Other possible uses are in the automatic control of railroad trains and ships.

Noted Inventor Rewarded

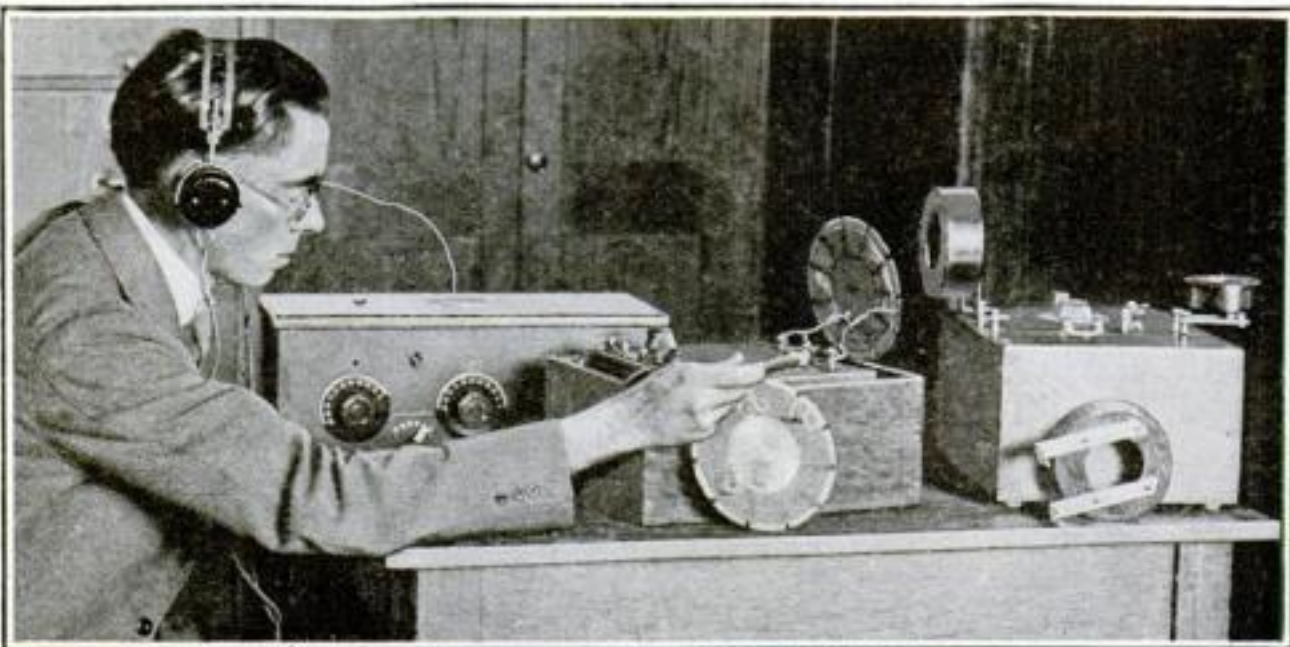
CLOSING a 12 years' legal battle, the United States Patent Office recently awarded the General Electric Company the basic patent rights of the so-called hard type of vacuum tube, used for radio and X-ray purposes. The tube was invented in 1912 by Dr. Irving Langmuir, assistant director of the General Electric Research Laboratory, but because of contests the patent was not granted until this year.

It is estimated that more than 10,000,000 tubes embodying the invention are in operation in the United States.

The tube is characterized by its hard, constant vacuum and its general reliability, permitting its manufacture in large sizes operating with more than 50,000 volts, as well as in small sizes such as are employed in the ordinary home radio receiving sets. Prior to this invention, all radio and X-ray tubes were of the type known as "soft." They glowed and acted erratically except on low voltages.

Tasteless Cod Liver Oil

HAVE you any disagreeable recollections of cod liver oil? If so, you will agree in calling Drs. Harry E. Dubin and Casimir Funk, biochemists of New York, real benefactors. They claim to have removed its bad taste.



Checking Up on the Broadcasting Stations

With about 500 broadcasting stations crowding the ether, it has become increasingly important that each station shall keep exactly on the wave length assigned to it by Uncle Sam. To check and measure the frequencies of distant stations, Morris S. Strock (above), of the Radio Laboratory, Bureau of Standards, has perfected this ingenious instrument—a sort of radio detective

Ideas to Use

It was only comparatively recently that scientists discovered why cod liver oil was good for babies. It is the richest source known of two vitamins, one that prevents rickets in children and another that wards off a serious eye disease that often results in blindness. After this discovery, efforts were begun to make an extract of the oil that would be easy to take.

Not only is the nauseous taste removed in the new extract, it is said, but it contains, in a given quantity, several thousand times as many vitamins as the original oil.

New Tunnel for Niagara

THE old Beddell stairway leading down past the "Rock of Ages" and into the Cave of the Winds at Niagara Falls is to be abandoned. A new subterranean passage 200 feet long has been bored through the great cliff over which the falls roars, connecting with a shaft sunk straight down from the surface of Goat Island.

At the mouth of the shaft is a peninsula named "Clearwater View," which affords a marvelous close-up view of the falls.

An Improved Headlight

FOR a long time the laboratories of the Westinghouse Electric and Manufacturing Company have been trying to find a good metal reflector for use in automobile headlights. What they sought was a reflecting material that could be cleaned with gritty waste without



He Weighs Human Brains

Doctor Arthur MacDonald, well known government psychiatrist, is shown here demonstrating on a fellow scientist how he estimates the weights of a brain of a living person by certain measurements. Given the brain weight, Dr. MacDonald claims he can analyze the mental capacity of any type of individual



Hunting
Pygmies
by Plane

Here are four members of an American expedition that recently left Chicago by airplane for a visit to the land of strange pygmies in the wilds of New Guinea. The expedition is headed by M. W. Stirling, former assistant curator of the Division of Ethnology of the National Museum, Washington, D. C., and is sponsored by the Smithsonian Foundation. Left to right: R. K. Peck, photographer; S. A. Hedberg, historian; H. H. Hoyte, chief pilot, and A. E. Hamer, chief mechanic



Amazing Tube Responds to Light

V. K. Zworski of the Westinghouse Electrical Research Laboratories, with his amazing new thermionic photo-electric tube designed to convert the power of light into electrical impulses. Physicists declare that the tube marks an important step forward in radio transmission of pictures, for it will send out electrical impulses whenever light falls on it

scratching, and be exposed to the weather without tarnishing or corroding.

Robert J. Piersol, research chemist, announced recently that it had been found. The new reflector has a surface of polished chromium, which is extremely hard. A popular reflector for automobile headlights has been silver or nickel plating on a smooth surface, but silver must be coated thickly with lacquer to protect it from the weather, while the reflecting qualities of nickel are not high. Chromium, it is claimed, has neither of these disadvantages.

Simple Test for Pearls

IN PARIS not long ago a group of the world's greatest pearl merchants watched a French scientist pour gently a handful of pearls into a tube containing what appeared to be water. Some sank to the bottom, but others floated.

"Gentlemen," the scientist said, "you will find that the pearls light enough to float in this fluid are natural pearls. Those that sank are cultivated Japanese pearls."

Thus he announced a discovery of great interest to jewel merchants and owners. Hitherto, Japanese pearls, those made by

oysters when a pebble or other foreign body is put in their shells, could be distinguished from natural pearls only by a complicated X-ray examination. The test with the mysterious fluid can be performed by an amateur.

Matches Made Waterproof

"NOTHING but soaked matches. We'll have to dry them out before we can have a fire."

This calamity, avoided by the experienced camper or woodsman, who packs his matches carefully in waterproof cases, is often suffered by the amateur. Now Morland M. Dessau has come to their rescue with waterproof matches. They can be dropped into water without spoiling them, he claims.

The heads are made of rubber latex mixed with the explosive material, the whole then being vulcanized.

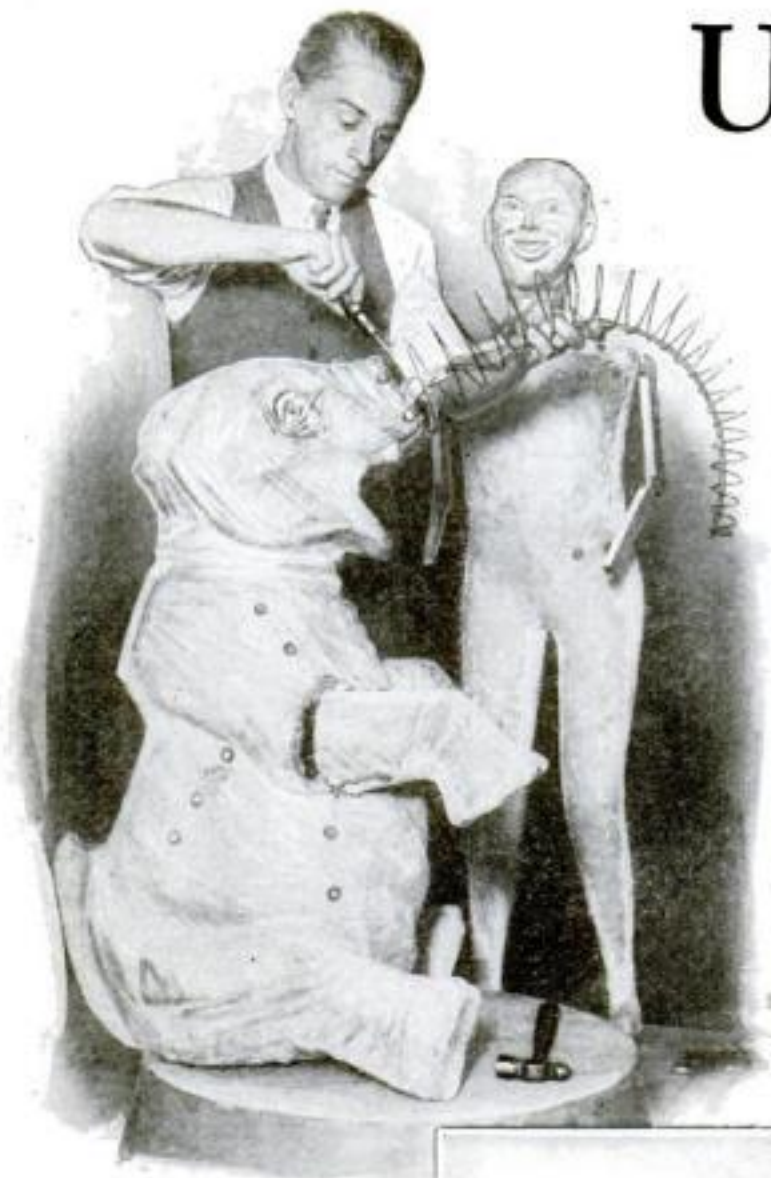
Can We Use Vegetable Fuel?

POWER from potatoes is Henry Ford's solution for the world's worry about fuel in the future. We can grow our fuel, he said in a recent interview, and convert it into electric energy to heat our cities.

Sawdust, apples, weeds—every bit of vegetable matter that can be fermented contains potential fuel. An acre of potatoes in one year will produce enough alcohol to drive the machinery necessary to cultivate the field for a hundred years, Ford declares.

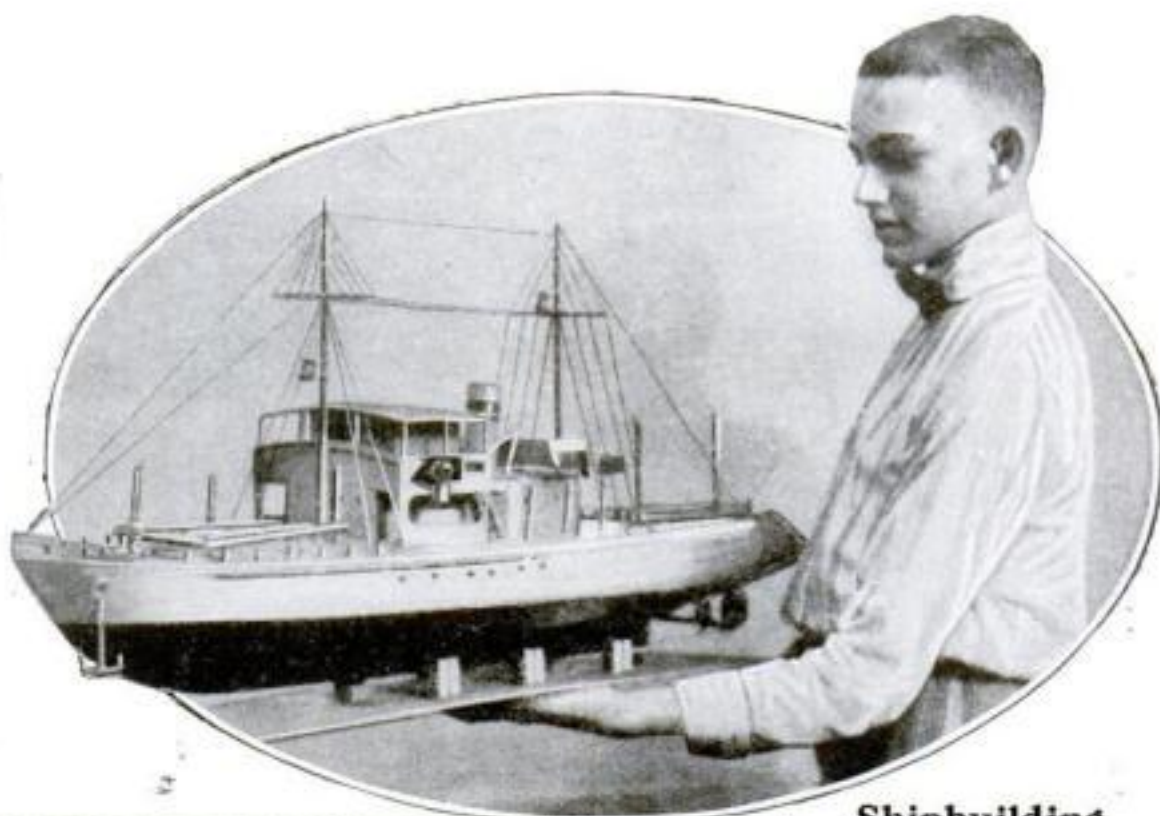
Among other things, Ford predicts that eventually coal would be burned underground at the mine and sent to consumers in the form of heat and power without ever bringing it to the surface

Unusual Products of Handicraft



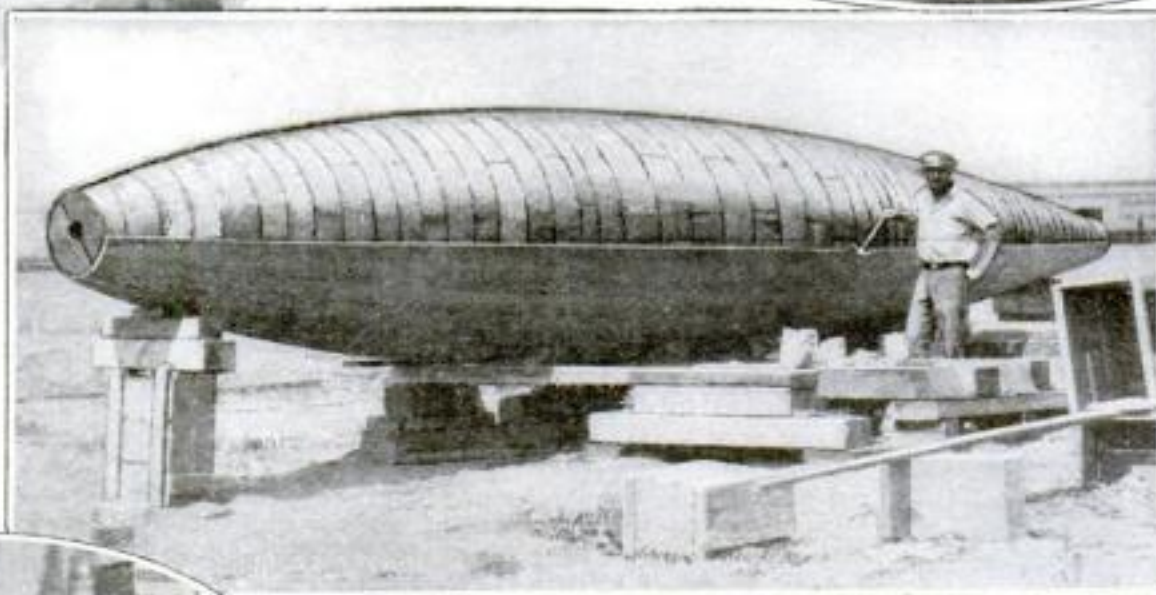
Making Animals to Order

A firm in New York City makes mechanical men and animals—anything from a tiny mouse, with every joint articulated, to the largest jungle beasts. The picture above shows how an elephant's trunk is built to move like a real one



Shipbuilding in Paper

Two thousand pieces of paper were used by painstaking young Thomas Northrop, a resident of the Panama Canal Zone, in making this amazingly accurate model of a ship



A New Type Submarine

A young Polish engineer, Alfons S. Kiebitzki, designed the submarine pictured above. Instead of the usual framework, its inner shell is composed of 56 cylindrical sections held together by iron rods



"Painting the Lily"

By a remarkable new electro-chemical process, Fred Maas, of New York, plates flowers, foliage, and even animal tissue with precious metals in such a way that the appearance of the original is retained for a long time

Model of California's Capitol

With a penknife, wood file, hammer, and his hands, John Maguelda, while a patient in a sanitarium at Weimar, Calif., fashioned this beautiful little model of California's state Capitol



Table Has 6000 Pieces

Six thousand bits of wood are in this inlaid table of well seasoned pine, upon which S. M. Perry, of Midian, Kan., has spent spare moments that amount to 1½ years

Have You Seen Them Any Bigger?



Climb and Read

You need a tall step-ladder and a roving pair of eyes to read the world's largest book, exhibited recently in New York City. Here is Bertha Green, of Greenville, S. C., scanning its pages, which are 10 feet tall and seven feet wide



Lost in a Chair

She's a girl of normal size in the world's largest office chair. It took two men to lift her there, for the gigantic chair is nearly 11 feet high and more than six feet wide

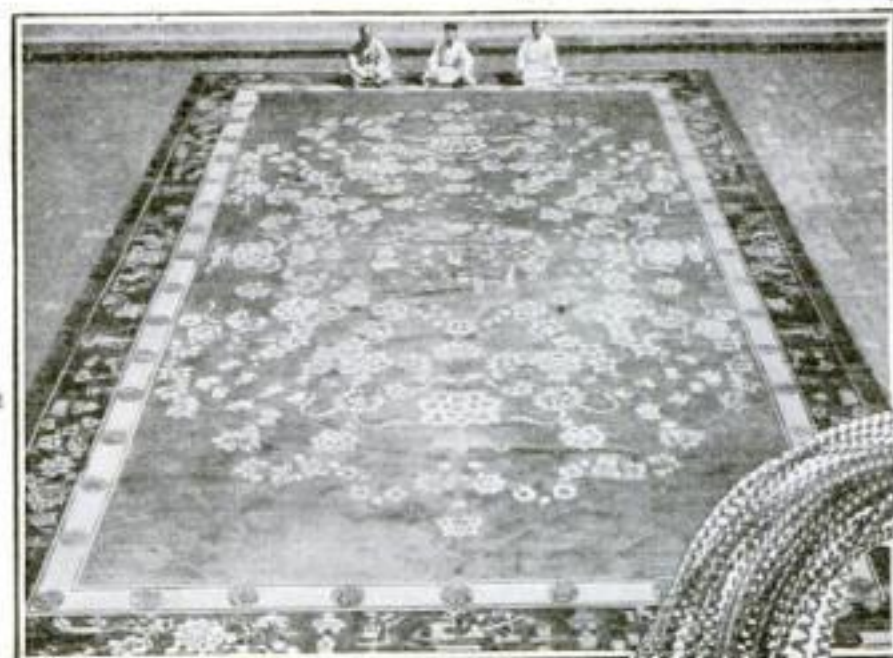
King of Banjos

It takes three men to play this giant banjo, built by Roy Kearns and A. Caro Miller of San Jose, Calif. It is 10 feet tall. The head was made from a 32-inch bass drum, and the strings are heavy piano wires



Longest Chip

One of the longest chips ever cut (below) recently came from a turbine bucket wheel in the shops of the General Electric Company, Schenectady, N.Y. The steel chip is 157 feet long and an inch in diameter



Would Fill a House

Part of the wall of a Chinese rug factory had to be torn down before this immense rug could be removed. It was woven for the Cincinnati Business Men's Club, where it covers 920 square feet of floor space. Comparison with the men will give an idea of its size



Big as a Chimney

Here is the largest pipe of an organ so powerful that its music can be heard for five miles. It was completed recently for a park in Los Angeles, Calif. This pipe, made of lumber three inches thick, is 32 feet long and three feet square at the large end. A 50-horsepower electric motor supplies power for playing

Strange Things and Places

Warbling Crickets Are the Canaries of the Orient

ALL the way across the Pacific recently, a tiny cricket sang with a voice as sweet and strong, it is said, as many a feathered bird. It was in a tiny bamboo cage, and came from Yokohama to a family in Seattle, who wanted it for a pet.

Both the Chinese and Japanese are fond of crickets for pets. They catch them in midsummer, put them in little cages and hang them in their rooms. The cricket that arrived in Seattle, it is said, sang not by rubbing its wings together, as our black crickets do in this country, but seemed to possess a different and mysterious kind of musical apparatus.

In the Orient there are big insect markets, where the natives buy their strange pets. The illustration at the right shows a Japanese woman in a Tokyo market choosing a cricket.

THE world's highest aerial tramway, from 15,000 to 17,000 feet above sea level, more than five miles in length, is used at a Bolivian tin mine.



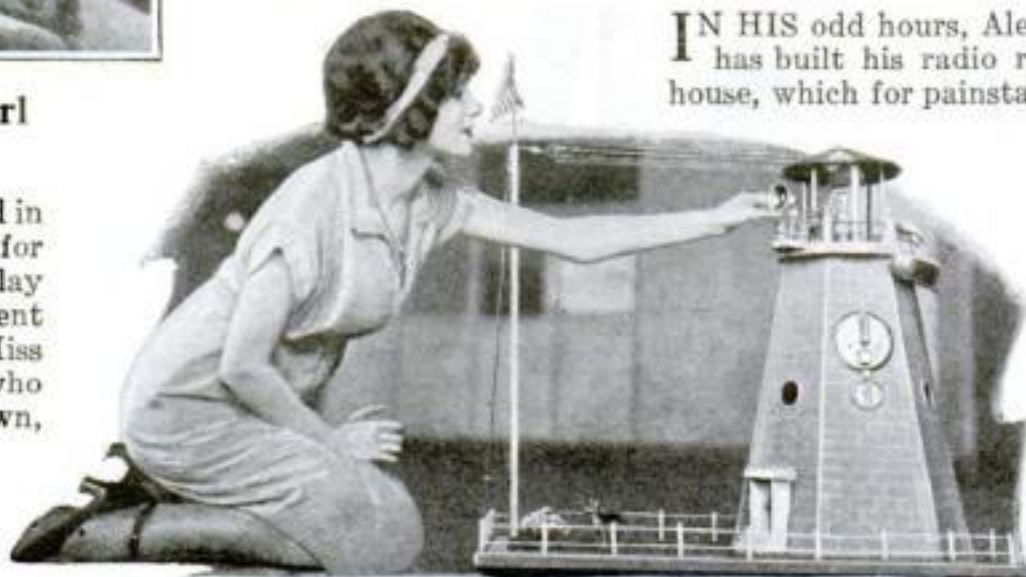
A cricket store in far Japan

Elaborate Little Lighthouse Is a Radio Set

IN HIS odd hours, Alex Goldstein of New York City has built his radio receiver into a miniature lighthouse, which for painstaking detail is a remarkable piece of workmanship.

The detector unit of a three-tube set is mounted in a glass inclosure at the top of the tower, while a two-stage amplifier is inside. A window forms the bell of the loudspeaker.

A tiny mast and flag-staff support a miniature antenna running to the top of the tower. Around the lighthouse yard is a white wooden fence, while in the yard is a realistic dog.



Novel radio set built in the form of a lighthouse

Where Roots Are Dug to Make Your Pipes

THESE irregular chunks, resembling lumps of coal, some day will be smoking pipes. They are chunks of briar roots being weighed on the island of Corsica.

White heath, or briar-root, grows extensively in the southern part of France and in Corsica. The roots are dug up, cleaned of earth and the decayed parts removed, after which the roots are weighed. They then are cut into blocks with circular saws. Cooking these blocks at a low temperature for 12 hours turns them a rich golden-brown color. The briar-root then is ready for shaping into pipes.



Briar-root for pipes being weighed for shipment

Realistic Camp-Fire Girl Made of Butter

A CAMP-FIRE girl modeled in butter won first prize for artistic and ornamental display of creamery products at a recent fair in Spokane, Wash. Miss Helen Kane of Spokane, who posed for it, wore the gown, moccasins, and honor beads of a Torch Bearer, the highest rank in the organization.

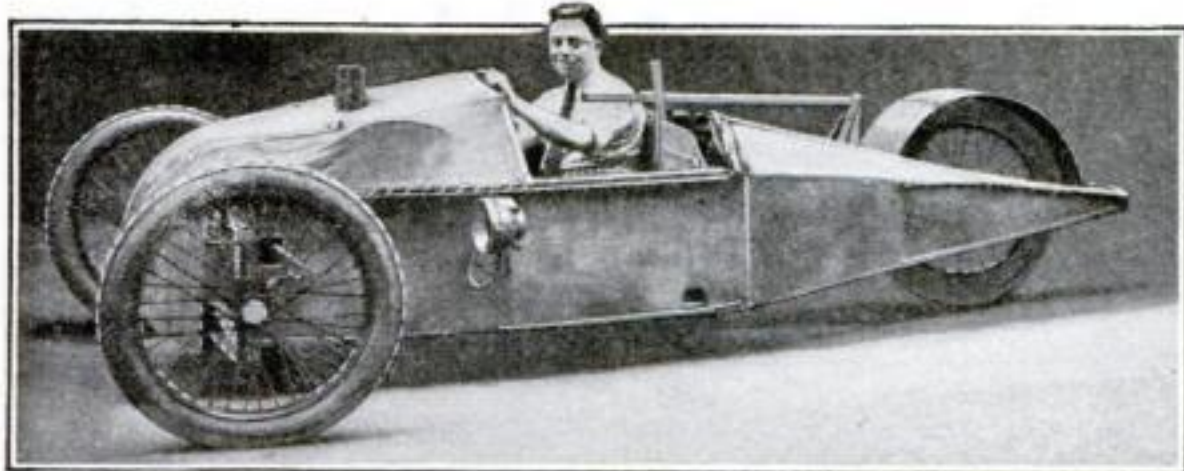
Howard Fisher, of Portland, Ore., made the statue, which was declared excellent both in its detail and in its general artistic effect.

Bright Colors Mean Little to the Peacock

WE MAY be misjudging the peacock and rooster when we call them vain birds. For Dr. H. Erhard, of Munich, who has been experimenting with the eyesight of birds, says that the shimmering colors in plumage probably mean nothing to the feathered creatures. At least, they do not appreciate colors as we do, if indeed they even distinguish one color from another.

Birds that fly by day, Doctor Erhard says, see everything in a bright red-orange light, being very slightly sensitive to the short waves that make up blue and violet. Night birds, on the other hand, never see red, but do see blues and violet. Tiny globules of oil in the retina of the eyes act as color screens and determine the birds' color sense, according to Doctor Erhard.

Seen by a Cameraman



Odd Cycle Car Made from Airplane Parts

OF ALL the strange vehicles seen on the streets of European cities, the one illustrated above is among the oddest. It is a motor car made entirely from spare airplane parts. Roger Ruenot, a Parisian, saw possibilities in the parts for a run-about and put them together as an experiment.

The car is fitted with a nine-horsepower motor and seats two persons. The body hangs low, barely clearing the ground. The inventor is shown just as he is about to start on a long tour with his unique car.

Old Signboard Demonstrates how Paint Resists Weather

THE unfriendly wording of this old painted wooden sign becomes more vivid each year, because during the years the background, unprotected by paint, has weathered away. Microscopic examination showed that rot organisms had not been responsible for this etching. Rain and heat alone are responsible for it.

"Weathering" is checking, cracking, splitting, tearing, swelling, and shrinking of the wood, caused by the alternation of wind and sunshine, and also includes any

mechanical wear from wind, rain, frost, or hail. It is not claimed that paint will entirely prevent rotting. Paint is, however, the best known protection against weathering.

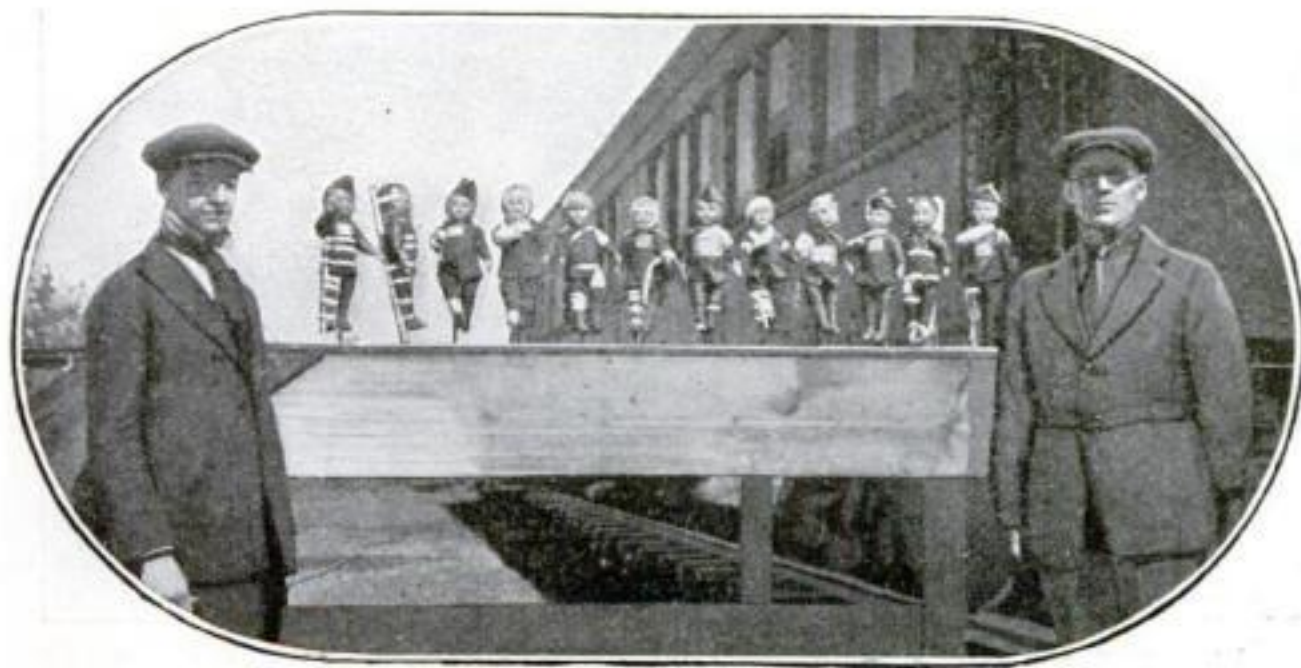


Signboard engraved by the weather

Troupe of Traveling Dolls Teaches First Aid

WHAT is probably the only collection of dolls ever made by a government agency is traveling in a special car through the United States, demonstrating to mining communities the correct ways for bandaging injuries. Some of the dolls have sprained ankles or fractured thighs, some broken arms, while others have their heads generously swathed, suggesting that class of common mine accidents caused by the fall of loose rock, slate, or coal upon miners' heads.

The Federal Bureau of Mines considers this demonstration by means of dolls its most effective way of teaching how to apply bandages before the arrival of a physician. The dolls are both masculine and feminine. A number of them are soldier dolls. The engineers and miners who live in the mine-rescue cars, with the dolls for company, naturally have applied nicknames to them. Among those seen in the picture are Jiggs, Blondie, Sally Ann, Cap'n Jinks, and Buddie.



How mining communities are taught to give first aid to the injured



13,000-lb. elephant standing on four small glass bottles

Huge Elephant's Only Support Is Four Half-Pint Bottles

TREAD lightly, Babe, and, whatever you do, don't try the Charleston. For Babe, you will see if you look closely, is standing on four empty half-pint bottles. And Babe is no light weight. In fact, he is said to be the largest elephant in the country, tipping the scales at 13,000 pounds.

Balancing on glass isn't one of Babe's ordinary stunts. He did it at the Public Zoo at Toledo, Ohio, recently for the entertainment of visiting glass manufacturers, who beamed when they saw this demonstration of the quality of American manufactured glass. For even under this tremendous weight, not a single bottle was broken.

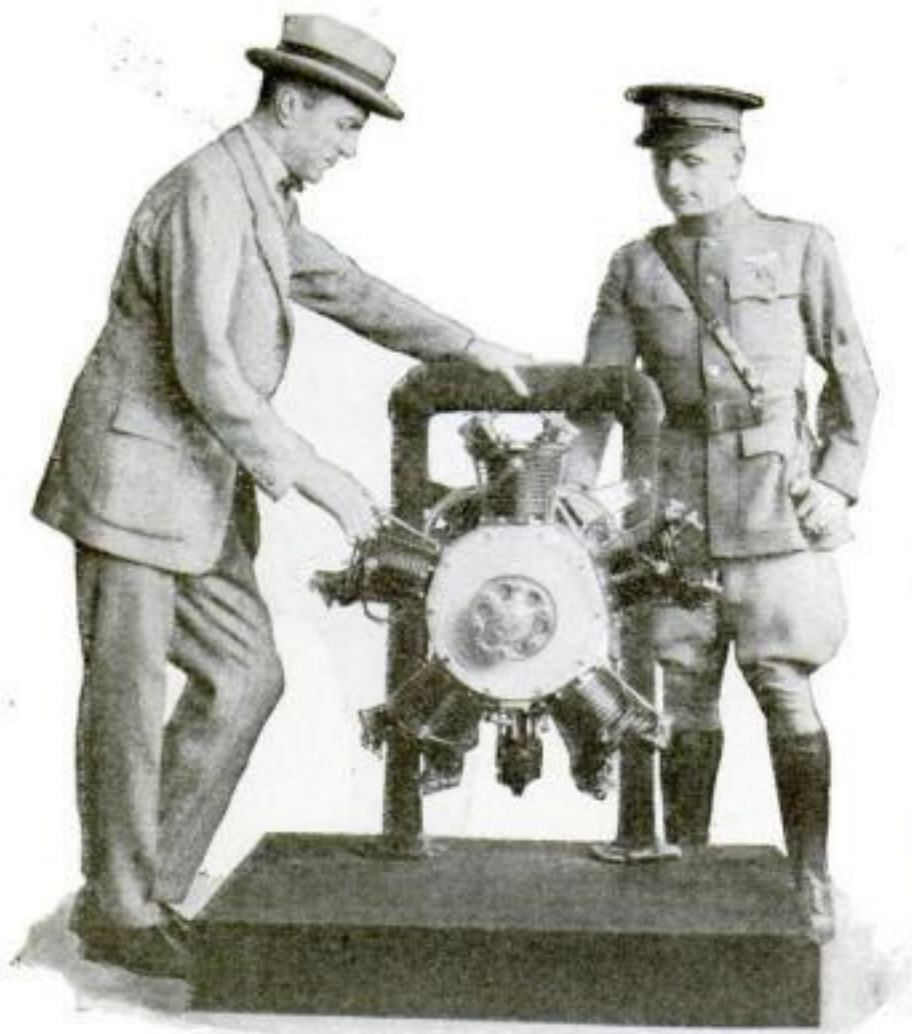


Radio Set Made into a Book

ONE of the interesting exhibits at a recent radio show in London, England, is the small volume shown above, which carries between its covers a complete radio set. Its maker, E. R. Fono, bound the book in tortoiseshell and entitled it "The Listener."

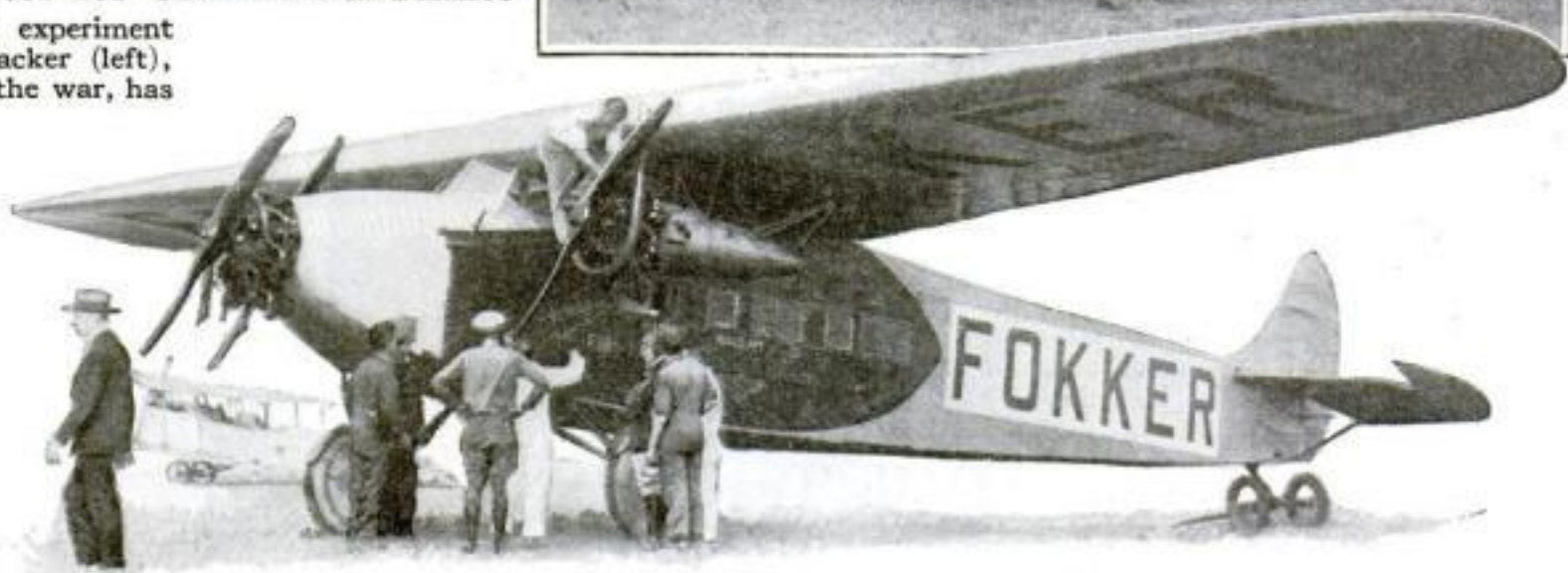
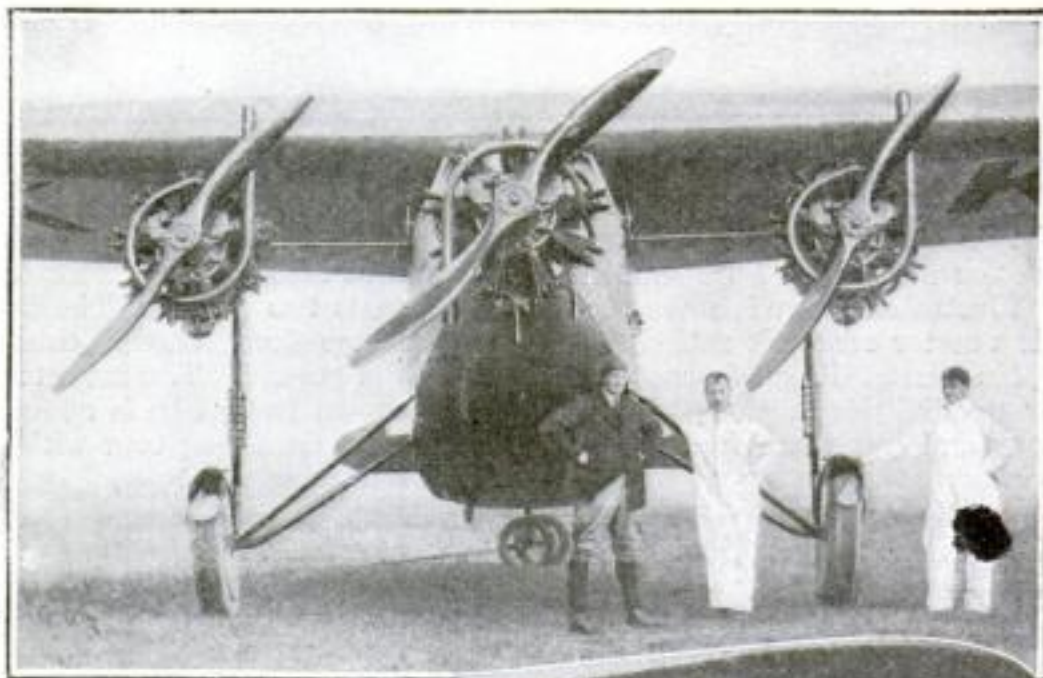
POPULAR SCIENCE MONTHLY will be glad to answer, wherever possible, all inquiries addressed to its Information Department.

On the Wing with the Airmen
**Newest Marvels
 of Aviation**



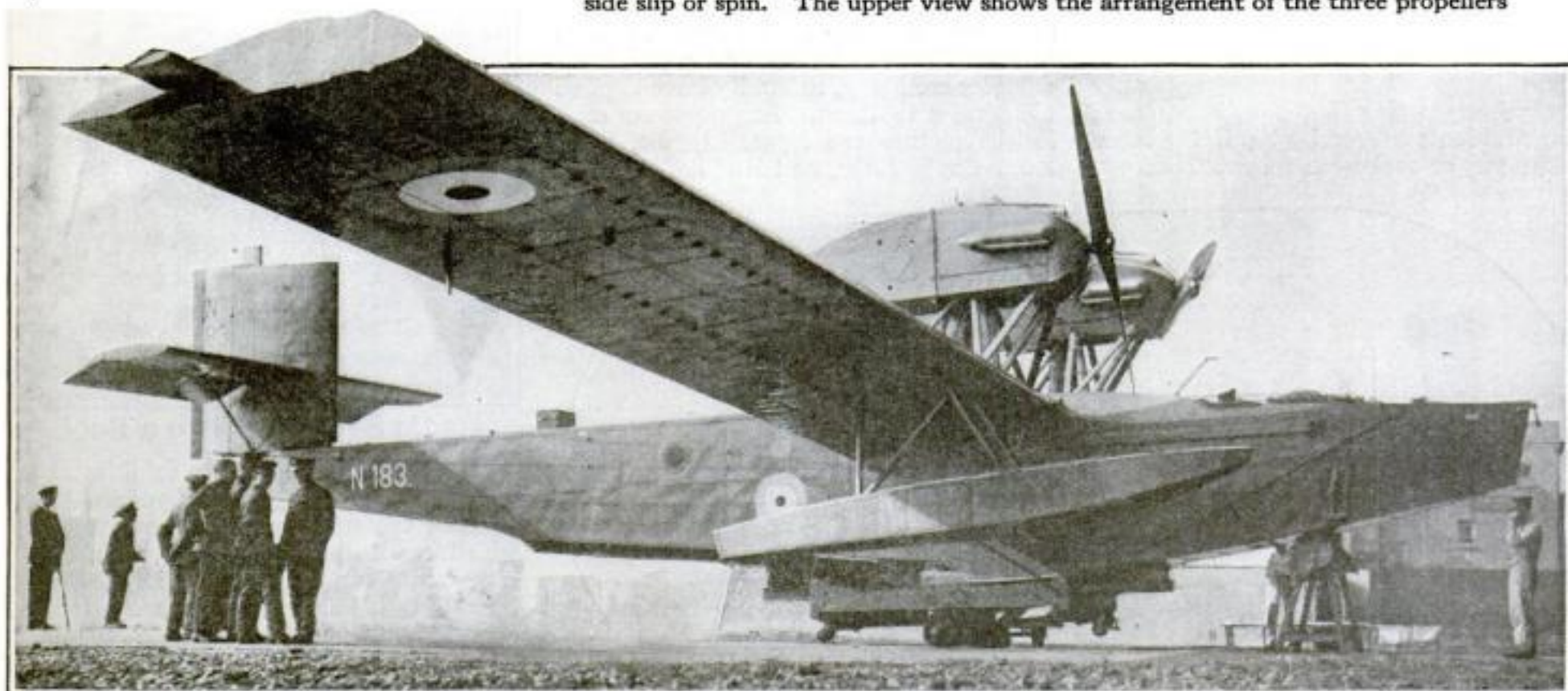
Designs New Motor for Commercial Planes

After seven years of experiment Capt. E. V. Rickenbacker (left), American ace during the war, has just completed this new type of rotary motor for commercial planes. He is seen demonstrating it to Maj. J. H. Rudolph, U. S. Army technical expert, at Mitchel Field, N. Y. Captain Rickenbacker is a leading figure in the development of commercial aviation.



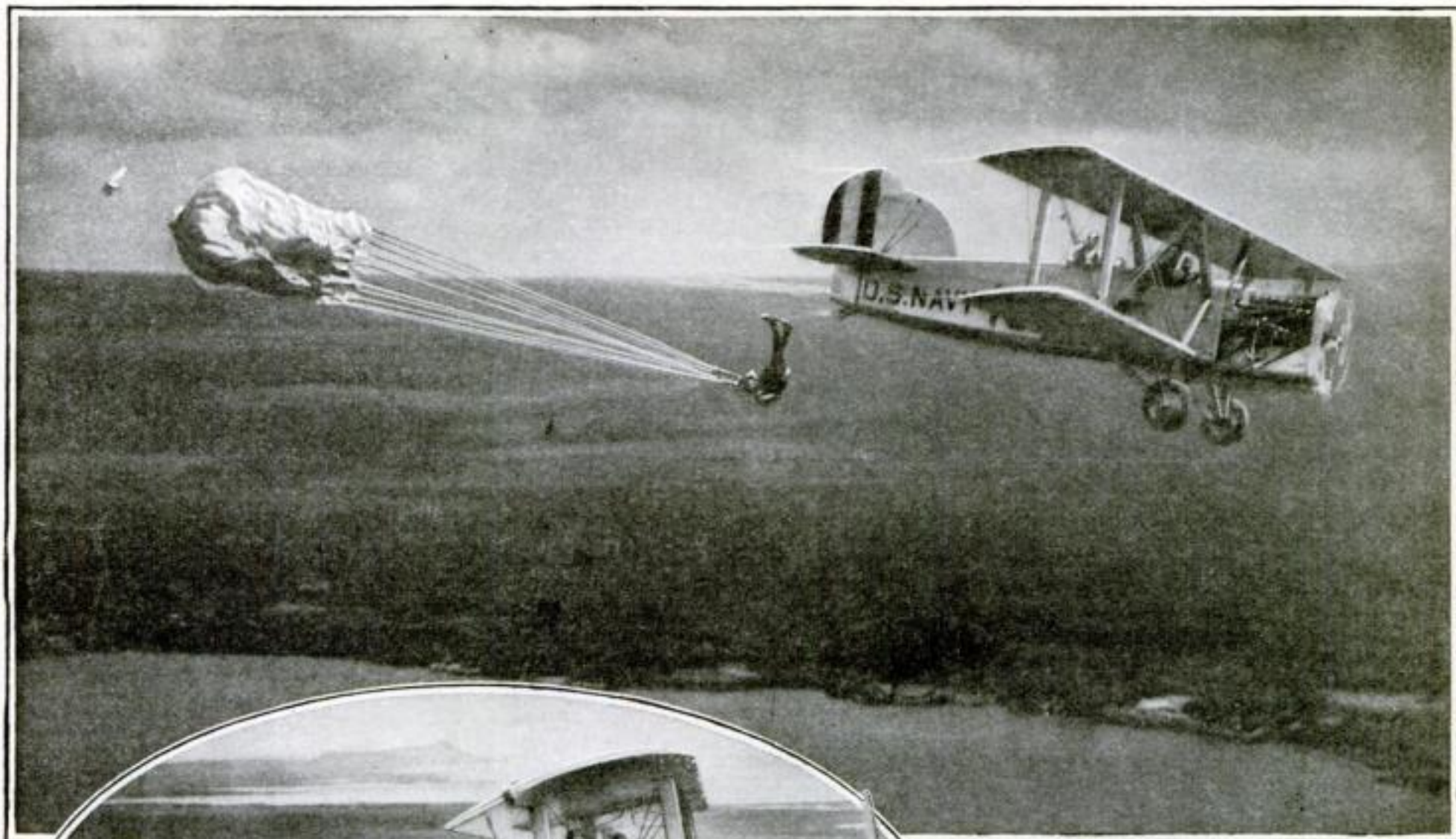
"Foolproof" Passenger Plane Driven by Three Engines

What is claimed to be the nearest approach to a foolproof airplane is this three-engine, 10-passenger Fokker monoplane, which, with engines stalled, refuses to side slip or spin. The upper view shows the arrangement of the three propellers.



The latest development in flying boats is this huge all-metal monoplane built by Danish designers for the British Air Ministry. The photograph shows the big boat at Felixstowe,

England, after a non-stop flight from Copenhagen. Even the wings are of metal. Notice the two motors mounted high above the fuselage, to escape flooding when boat rides the water.



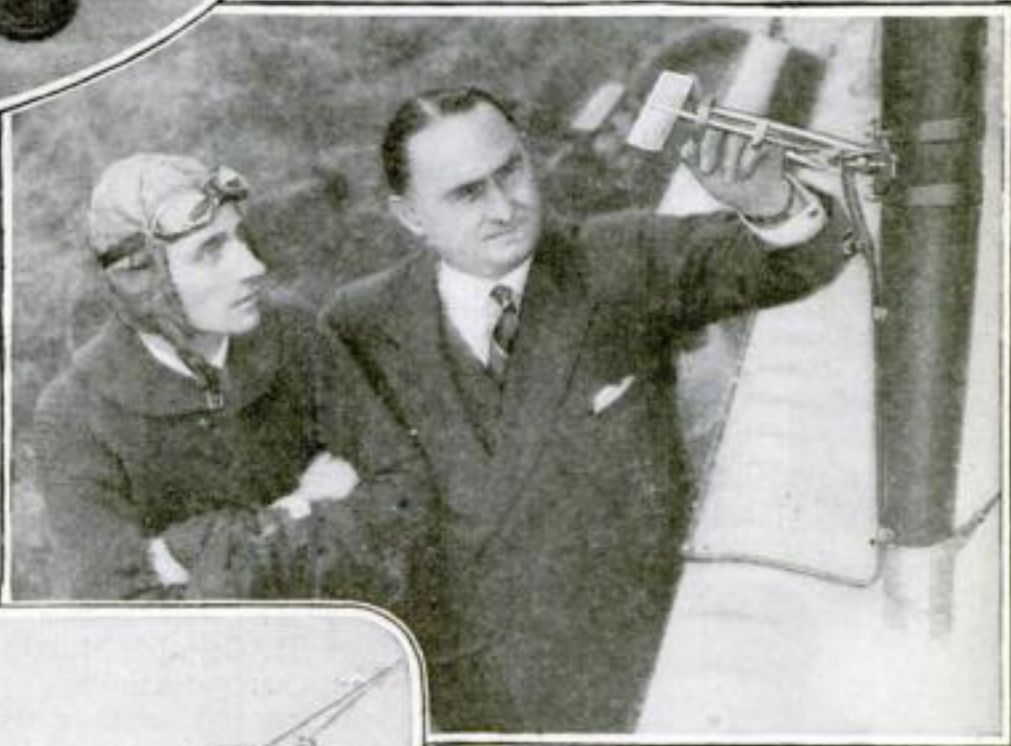
Lieutenant Tate standing on the wing of the plane just before making his remarkable jump

A Thrilling Parachute Jump

Here is a most remarkable photograph of a parachute jump. The camera caught Lieut. J. R. Tate an instant after he left the wing of a navy plane 2000 feet above beautiful Pearl Harbor in Honolulu

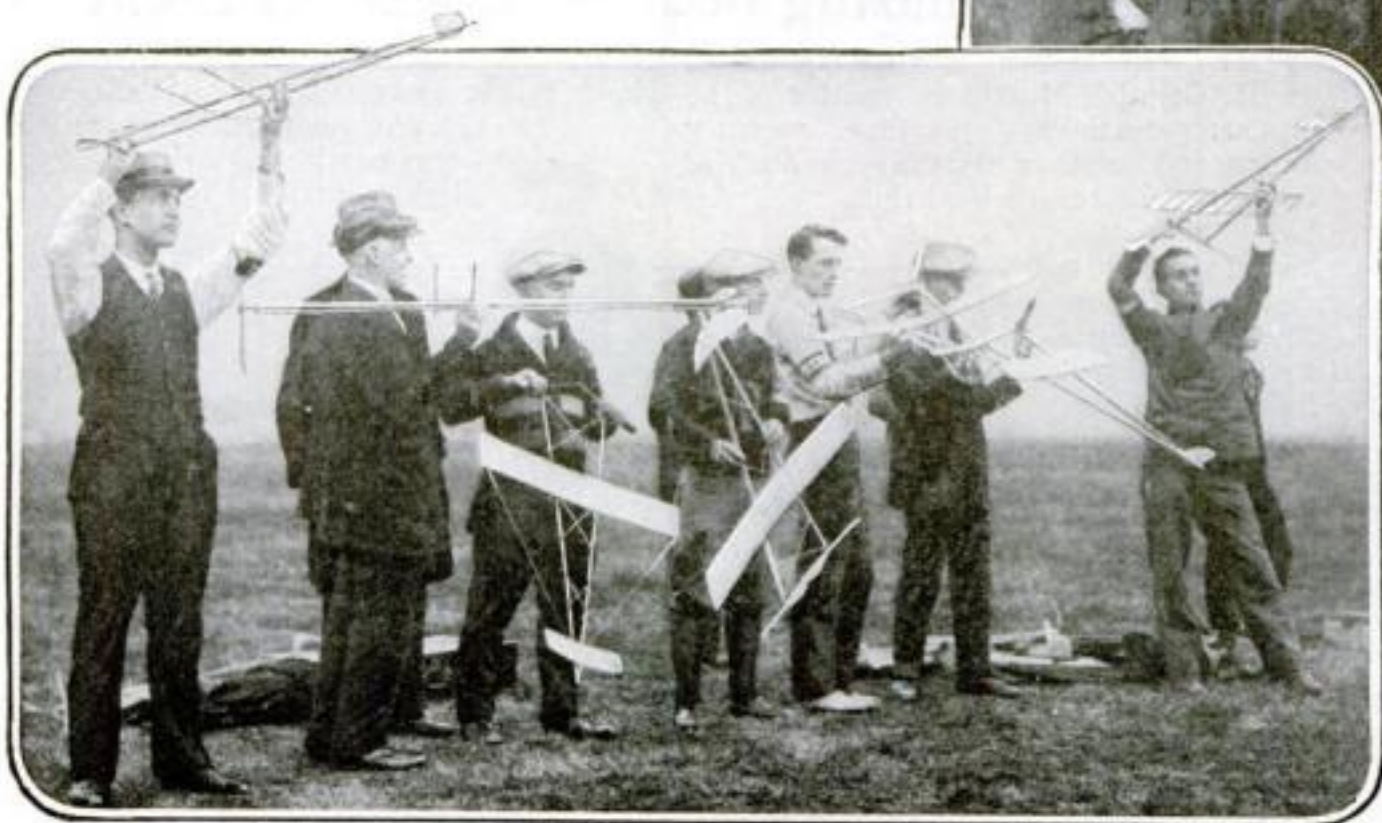
Miniature Planes Compete in Races

Model airplanes had their day of racing during the International Air Meet at Mitchel Field. Youngsters from aviation clubs in all parts of the country were given a chance to demonstrate their remarkable miniature machines and to match their skill in flying them. The photograph below shows some of the entries in the competition



Safeguard for Pilots

A remarkable device to prevent stalling of a plane in flight has been perfected by Major Jack Savage, inventor of sky writing (right), who is seen demonstrating the device to C. B. Collyer, skywriting pilot. A miniature wing or vane is attached to a strut near the end of the wing. Ordinarily the vane remains level, but if the nose of the plane points upward at a dangerous angle, the wind flow pushes the vane up, opening a valve. This is connected through relays with a pneumatic device that pushes the control lever forward, warning the pilot of his danger



Some Inventors *and*

He Fries Eggs on a Cake of Ice

WOULD you believe it possible to fry an egg in a frying-pan held over a cake of ice? To demonstrate that it can be done, Bernays Johnson, well known New York radio engineer and inventor, recently devised the apparatus pictured at the left.

The probable explanation is this: Beneath the table top is concealed a coil of wire through which high frequency current is passed. When the frying-pan is placed in the magnetic field of this coil, an electric current is induced in the iron of the pan, heating it sufficiently to cook an egg. At the same time the current has little or no effect on the cake of ice resting on the table.



Bernays Johnson frying an egg over a cake of ice

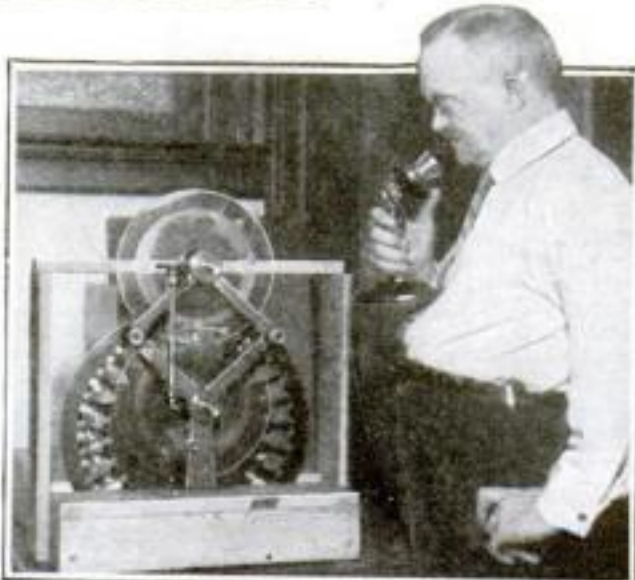
Talking Motion Pictures Sent by Radio

SOME day soon you may sit at home and receive a whole moving-picture show over your radio. Not only that, but the actors actually will talk.

At the right is C. Francis Jenkins, of Washington, D. C., experimenter in radio vision and radio movies, demonstrating the apparatus with which he recently transmitted a motion picture and verbal description of it at the same time.

Foot Toboggans Provide a Novel Winter Sport

PROBABLY every boy has tried sliding on barrel staves or other improvised snowshoes. It was while helping his own boys to build sliders that a Missouri manufacturer hit upon the idea of the foot toboggans pictured below. Resembling sandals, they are strapped to the shoes like skates. The soles are of thin corru-



C. Francis Jenkins with talking movie machine

gated metal, to provide traction on smooth ice, and so make it possible to control movement. They can be used either for skating or coasting.

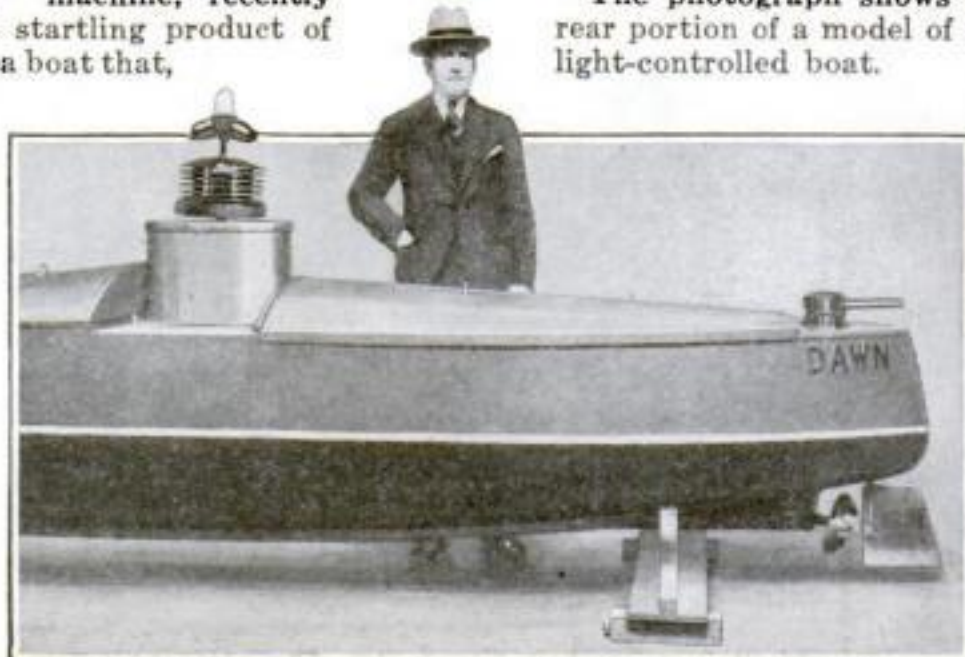
Guides Amazing Boat by a Beam of Light

THE well known English inventor, H. Grindell-Matthews, creator of the famous "death-ray" machine, recently announced another startling product of scientific research—a boat that,

he claims, may be guided from a distance of more than five miles by a beam of light. The beam striking an instrument on the conning tower of the boat, will operate the engine, steer the boat in any direction, the inventor says, and also will fire a small gun mounted at the stern. For

coastal defense in time of war, such a boat might prove exceedingly effective.

The photograph shows the rear portion of a model of the light-controlled boat.



H. Grindell-Matthews beside a model of his light-controlled boat

Michael V. Ventrella shows how easily his pedal device turns a page of music



Young Musician Perfects Automatic Page Turner

AFTER seven years of patient experiment, Michael V. Ventrella, a young New York musician, has invented an ingenious pedal device that makes it possible for the musician to turn pages of music without taking his hand from the instrument he is playing. All that is necessary is to step on the pedal that actuates an arrangement of levers that turns the pages of the music automatically.

The device can be applied to a piano as well as to a music stand, the inventor claims, and can be adjusted to turn the pages of a book at any height. When idle it holds the pages flat and firmly on the rack, and so keeps them from blowing in the wind and causing the player to lose his place. It is said to be noiseless in operation.

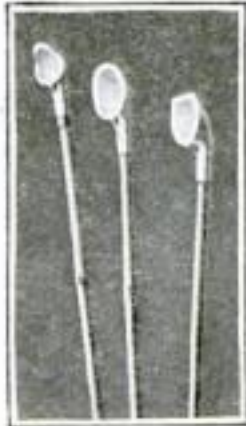


Strapped to the feet like skates, the shoe toboggans can be used either for coasting or for skating

Their Ingenious Products



The inventor showing how the golf ball is driven with an over-head hurling motion



Hurler, mid-hurler, and the sinker

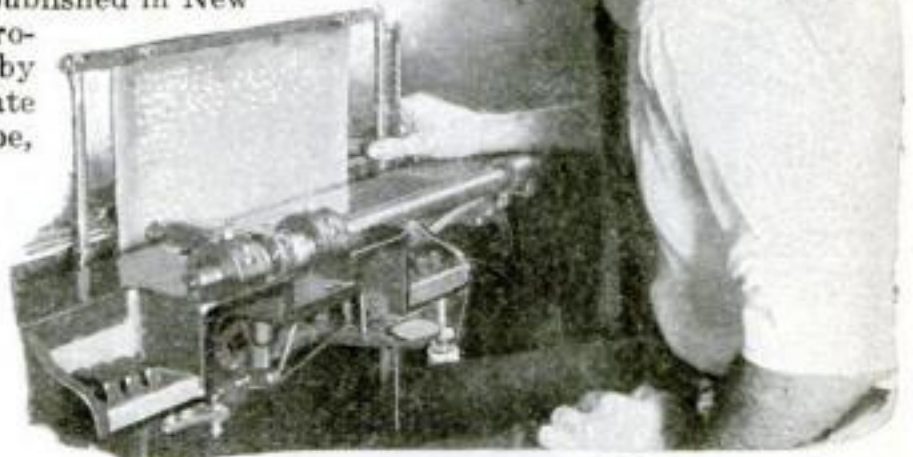
Crippled with Rheumatism, He Invents New Golf Game

HANDICAPPED in his golf game by rheumatic pains that troubled him every time he swung at the ball, N. E. Warwick, of Cleveland, Ohio, refused to give up his favorite sport. Instead, he invented a remarkable new form of golf, in which the ball is hurled with a whipping motion above the head instead of being driven from the ground.

With light, whiplike sticks he now claims he can make a better score than ever before. The heads of the sticks are cups that hold the ball. Warwick has developed three kinds of clubs—the hurler, for the long shots ordinarily made with driver or brassie; the mid-hurler, corresponding to the midiron; and the sinker, corresponding to the putter. With the hurler Warwick claims to get more distance than the ordinary golfer gets in the average drive off a tee.

Embossing Machine an Aid to Blind Printers

ONE of the most remarkable publications in the world is the *Ziegler Magazine for the Blind*, published in New York City; for it is produced almost entirely by blind persons. To facilitate the printing of braille type, in which combinations of tangible raised dots represent the letters of the alphabet, Joseph Brusca has invented the machine shown at the right. It is used in an improved method of embossing press plates.



Joseph Brusca embossing braille letters with his new machine



The inventors with their "gravity motor"

The Latest Idea in Perpetual Motion Machines

ANOTHER perpetual motion machine! Till the end of time men will keep at it. You can't discourage them.

The undiscouraged inventors in the photograph are W. J. Winkelman (left) and J. K. Deem, of Los Angeles, who claim to have invented the only workable perpetual motion machine offered to the mechanical world. Through a combination of levers, it utilizes the law of gravity, they explain. The inventors believe that gravity motors will make the desert and remote sections of the country habitable by providing self-generating plants for lighting, heating, and household needs.

Revolutionary Steam-Boiler

A STEAM-BOILER of revolutionary design has been produced by a German engineer-inventor, Bernhard Becker. When stripped of its insulation, it is a cubical box only about 18 inches on a side; but its inventor claims it can produce more than 600 pounds of steam an hour and get up a pressure of 300 pounds to the square inch in five minutes.



Traffic Cop a Semaphore

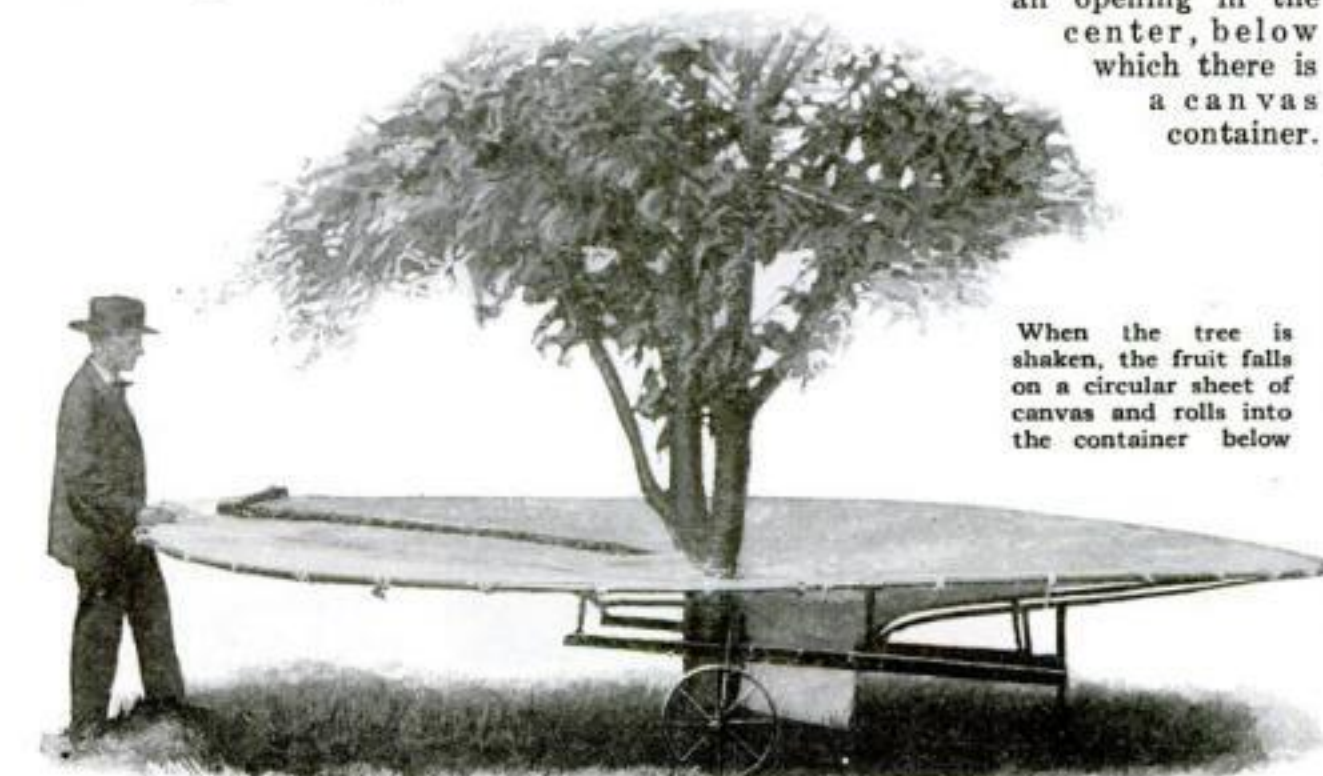
TO SAVE trouble and confusion in regulating traffic, A. Seua, a Malay policeman, carries his own semaphore in the form of light, basket-woven "wings" strapped to his back. Whenever he is ready to change the direction of traffic at a street corner, all he needs to do is to turn his body to give the signal, which no driver can mistake easily.

Canvas "Lap" Gathers Fruit without Bruising

IN ORCHARDS near Portland, Ore., a unique fruit gatherer is being used to catch all of the fruit without bruising it. The device, perfected by Arthur Hedden

of Portland, is mounted on wheels like a wheelbarrow.

When the tree is shaken, the fruit falls on a sloping sheet of canvas and rolls into an opening in the center, below which there is a canvas container.



When the tree is shaken, the fruit falls on a circular sheet of canvas and rolls into the container below

Sixteen Answers to a

Improved Utensils and Conveniences to Meet the



For More Space in the Kitchen

At the right is an over-the-sink cabinet that is very handy for all the many small things used in a kitchen. An under-the-sink table is also used in conjunction with the cabinet. It contains drawers and a compartment for all the kettles



Electric Light Cooks Food

With the heat of ordinary electric-light bulbs it now is possible to cook and bake. This new cooking device is said to reduce the fuel bill considerably. Food is put in the container and the current turned on



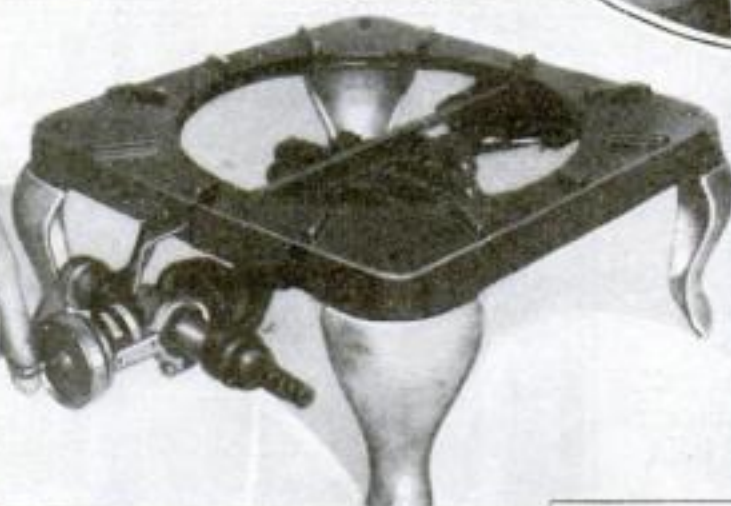
Wheels Cut Can Open

A pair of shearing wheels does the cutting. This can opener uses the principle employed for shearing metal in factories. The shaft on which the wheels turn is pivoted on a punch inserted at the can's center



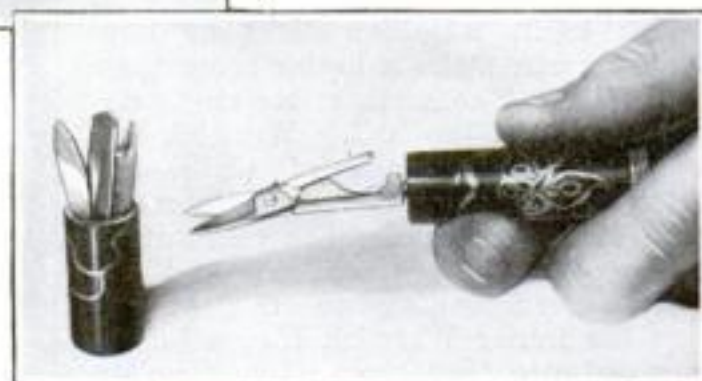
Handy Milk-Bottle Holder

Sally won't come home crying over spilt milk. Her mother gives her a new milk-bottle carrier to take with her to the store. It fits over the bottle and provides a convenient handle. It can be used, too, to hang up the milk bottle



Tiny Manicure Set

Handy for a woman's bag is a manicure set with four tools, carried in a case three inches long. Each tool screws into the end of the case. The case is made of a non-inflammable celluloid substitute, prettily engraved



It Closes Gas-Stove Leaks

To prevent accidents from escaping gas, a thermostatic control for gas appliances has been devised. If for any reason the gas pressure gets low or the gas goes out completely, a rod extending over the gas burner contracts, closing the valve automatically

For Left-Handed Peelers

Considerate of the left-handed housekeeper, a manufacturer has made an adjustable potato peeler that can be fixed to accommodate her. At the right is the device adjusted for left-handed peeling



More Heat from the Fireplace

The device at the left prevents heat waste by doubling a fire's radiating surface. Fresh air enters through the hearth and hollow and irons to a distributor behind the fireplace. It flows through flexible copper heating tubes to a register above the fireplace, then out into the room. The equipment is said to work in any fireplace that burns without smoking. The air may be run through a pipe from the outdoors



Housewife's Problems

Demands of the Wide-Awake Woman



Opens Cans with Key

This unique can opener has nothing on which the housewife can cut her fingers—no knife; no sharp edges at all. It clamps on the side of the can and the key is turned to remove the top of the can.

Wax Paper Folds Neatly

With wax paper put up in the convenient form shown below, one sheet at a time can be removed without disturbing the rest. The balance goes back in the roll, which is secured by the folded cover and a string.



Newest Electric Refrigerator

This electric refrigerator is claimed to be practically silent in operation and to require no attention for lubrication. All the refrigeration mechanism is contained in one unit, set in the brine tank through the top of the cabinet. The unit is suitable to several sizes of boxes. Corkboard insulation is used and easy access for cleaning is made possible in the food compartments. Ice trays for freezing cubes also are included. The only maintenance required is to shut down the machine overnight once or twice a month to allow the accumulated frost on the brine tank to melt away.



Folding Crib Saves Space

Do you remember the old-fashioned crib that rolled under the bed? Here is a modern version of it. The mattress and bedding remain on the bed when it is folded. It is a space saver, yet provides plenty of room for a child.



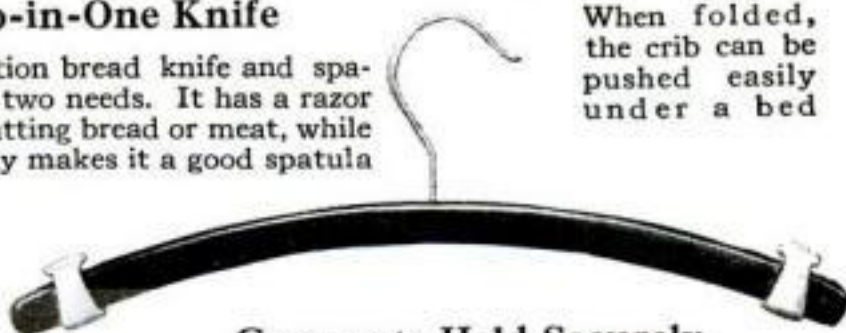
How the crib appears when in use. It is securely locked in position.

Two-in-One Knife

A combination bread knife and spatula serves two needs. It has a razor edge, for cutting bread or meat, while its flexibility makes it a good spatula.

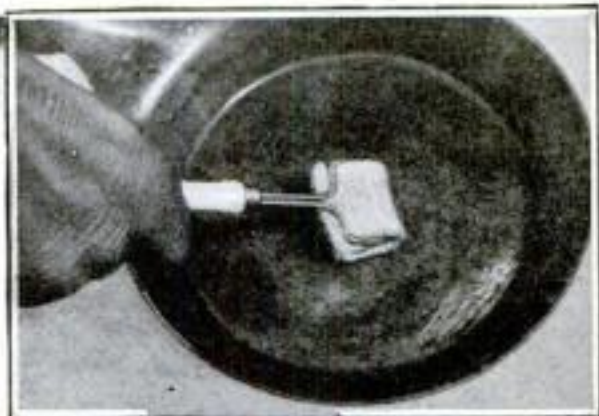


When folded, the crib can be pushed easily under a bed.



Garments Held Securely

Rubber tips for garment hangers keep the garments from slipping off and falling to the floor. The tips may be moved at will.



To Grease the Griddle Pan

A new piece of cloth for each griddle greasing may be fastened in this wire holder. A small pan for the grease is provided.

Cherry Pitter Leaves Fruit Whole



This aluminum cherry pitter drives the stone out in a moment, leaving the fruit whole. It fits the hand and there is no crushing of the fruit.

Coins Sorted and Counted Automatically



Counting machine, showing hopper filled with unsorted coins

FOR business houses where thousands of coins of all denominations must be counted in a day, this ingenious automatic coin-sorter and auditing machine has been perfected.

At one end is a hopper into which coins, bills, and checks are emptied. After removing the paper money, the operator simply presses a button to start the machine. In a moment all the coins are sorted automatically, counted accurately, and wrapped.



This Fountain Pen Holds a Supply of Stamps

HOW many times, after writing a letter, have you found yourself without a stamp to send it through the mail? Here is a simple but ingenious device that makes it possible to have a supply of stamps always on hand when you need them—right in your fountain pen. A strip of stamps is wound on a small drum that fits inside the pen.

New Air Meter Records Tire Pressure Automatically

NO LONGER is it necessary for the motorist, getting "free air" at the gas station, to disconnect the air hose from the tire valve frequently to test the pressure in the tire.

An automatic air meter is the latest device for the gas station. The motorist sets the dial, shown in the photograph, at the exact pressure he desires in the tires.

When the dial is set, a light, to which the operator is pointing, comes on. All that is necessary now is to attach the hose to the tire. When the tire is filled to the pressure indicated, the light goes off.

Latest Automobile Will Be Driven by Oil Pressure

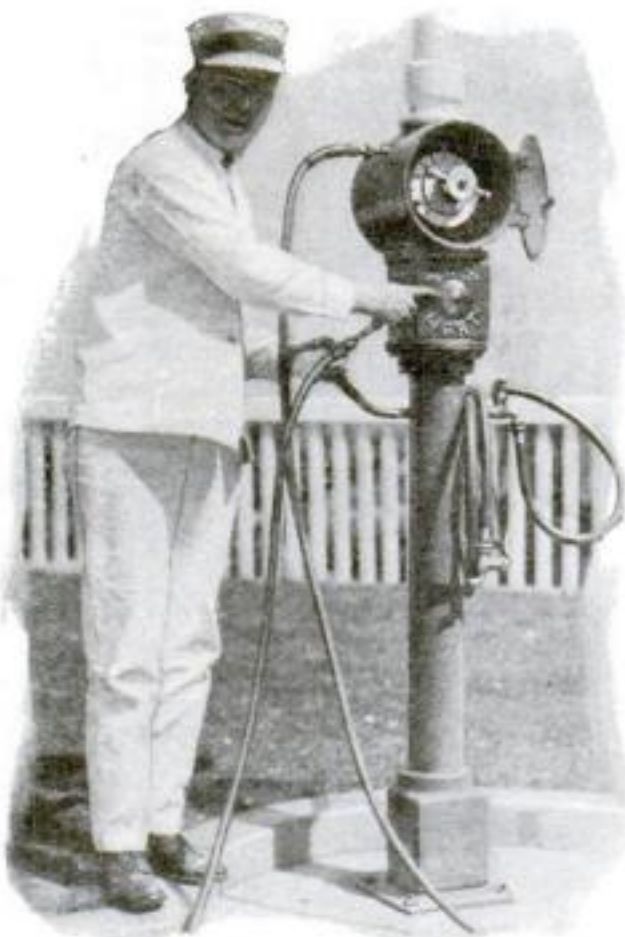
AN AUTOMOBILE of revolutionary design, driven by oil pressure, is to be manufactured in Lansing, Mich., according to recent reports. Gears, driving shafts, and brakes are to be replaced by oil-pressure pipes.



A Collar Clasp that Lies Flat on the Neck

ALMOST every man has dreamed of perfecting some kind of a button for the back of the collar that will lie flat without pressing against the nape of the neck uncomfortably. The latest idea is this button that is made in the form of a clamp.

When the head of the button is inserted through the holes of the collar band and collar, a spring hinge snaps it tightly against the base. The device may be used also as a tie clasp.



A light signals the air pressure

Loudspeaker to Give Warning of Earthquakes

A REMARKABLE instrument that translates the slightest tremors of the earth into sounds that issue from a loudspeaker is the recent invention of a Japanese professor, Dr. Jun Shida of Kyoto University. It is designed to give warning of the approach of earthquakes.

The possible usefulness of the invention lies in the assumption that most severe earthquakes are preceded by slight shocks. Thus, an audible warning of slight tremors would give people time to leave homes and office buildings before the arrival of a destructive quake.

The invention consists of a pendulum, an electric coil, and an amplifier. The pendulum is so delicately poised that it responds to the slightest vibration. When it is set in motion, electricity is generated in the coil, which actuates a sound-producing device. The sound is amplified and issues through a loudspeaker.

Further improvements will make it possible to transmit directly by wireless the sound generated by the first tremor.

Rod Holder Devised for the Lazy Fisherman

PERHAPS, if you are the kind of fisherman who gets tired of holding a pole hour after hour, you have had the surprising experience of returning to the creek and finding that your rod, which you left stuck carefully into a mud bank, has been pulled out into the middle of the stream.

For you there has been invented a new rod holder. An 18-inch metal spike is driven into the ground and to this is attached a clamp that grips the handle of the fishing-rod. The rod can be adjusted easily and quickly to various positions, and it is

claimed that it is impossible to pull the rod out by a forward pull. The picture below illustrates how the holder does the fishing while the angler looks on.



The rod is held tightly while the fisherman lights his pipe



This Pencil Writes in Five Different Colors

A POCKET pencil that will write in any one of five colors is a new convenience for the office man. It is of the self-feeding type. When a lead of a certain color is to be used, an indicator near the point is turned until it registers the desired color. A twist on a knurled knob at the end of the holder then ejects the lead at the point.

The pencil has a clip to fasten it to the coat pocket.

New Type of Dolly Truck Makes Heavy Work Light

TO FACILITATE the handling of heavy rolls of paper, an Indiana printer has invented the compact but extremely sturdy new type of dolly truck pictured at the right. It has been found equally useful for moving heavy crates, barrels, drums, casks, and other bulky loads.

The truck has six wheels. An unusual feature is that the wheels on the center axle are slightly larger than those on the two ends, thus acting as a pivot and permitting tilting. The truck is built low, with projecting skids sloped to within two inches of the floor so that articles can be loaded easily.

Loads with curved surfaces, such as paper rolls and barrels, that usually have to be blocked to keep them from rolling from the ordinary truck, are held securely by the slanting sides of the truck frame.



The new dolly, loaded and empty

Charcoal Gas New Substitute for Gasoline

THAT charcoal gas can be used effectively as a substitute for gasoline in motor vehicles was demonstrated recently by the French government in a 1500-mile endurance test for cars using this new form of fuel. It was found that a

motor-truck burning charcoal and using the gases of combustion in its cylinders, costs less than one-fourth as much to operate as a similar truck burning gas.

For the use of charcoal gas, no changes in the design and construction of the

motor are necessary it is said. The car, however, must carry a wood- or coal-burning furnace, which is fed with charcoal blocks. As the charcoal burns, the gas rises to the top of the furnace, whence it is carried off to the motor. There the gas is ignited, much the same as in the gasoline car, and its expansion supplies the power to drive the pistons of the automobile's engine.



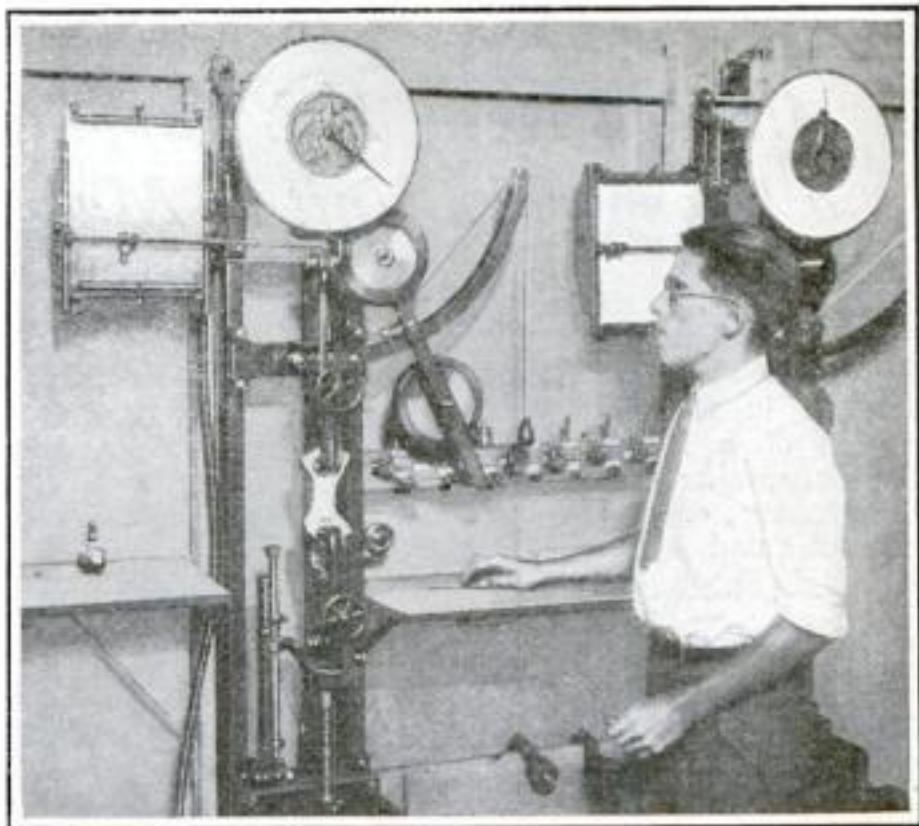
Filling furnace with charcoal blocks as a substitute for gasoline

Measuring Wear on the Seats of Trousers

HOW many times can a man sit down without wearing out the seat of his trousers?

A definite answer to this really important question now can be obtained in round numbers from a novel textile-testing machine devised by the U. S. Bureau of Standards to measure the durability of cloth used in making army uniforms.

When applied recently to a new quality of cloth for army trousers, it was found that the wearer could sit down 97,000 times before the cloth showed the least sign of wearing through.



W. J. Stephenson, textile tester of the U. S. Bureau of Standards, measuring wear on trousers seats by the textile-testing machine

Improved Barbed Wire Is Easier to Handle

SHIPPING and putting up ordinary barbed wire takes a great deal of time. The wire tangles easily, and on account of the barbs it cannot be wound tightly on spools. When it comes to stretching it, torn hands and clothing so often result that stringing barbed-wire fences is counted one of the mean jobs on a farm.

A new product called "barbed band," eliminates most of these difficulties, for it is collapsible. In other words, its barbs are folded like knife blades for shipment, and show up only when the wire is stretched. The wire consists of strong hoop iron punched on both sides, leaving a small barbed band that can be stretched easily.

A ring of about 22 yards of the punched band, weighing about 20 pounds,



showing no barbs, and taking little room contains more than 127 yards of the barbed wire. The sides of the band are very sharp, giving additional protection.

The band may be used not only for fences, but makes a good substitute for wire grating.

THE glarimeter, the only instrument invented for measuring gloss of paper, has just been adopted by the U. S. Government as the legal standard for newsprint.

A Loudspeaker You Can Build

All You Need Is Wrapping Paper, a Chopping Bowl, and a Phonograph Unit to Make It

BY ALFRED P. LANE

LARGE numbers of our readers undoubtedly will be interested in the description of a home-built loudspeaker that is inexpensive, easy to construct, and gives surprisingly good results.

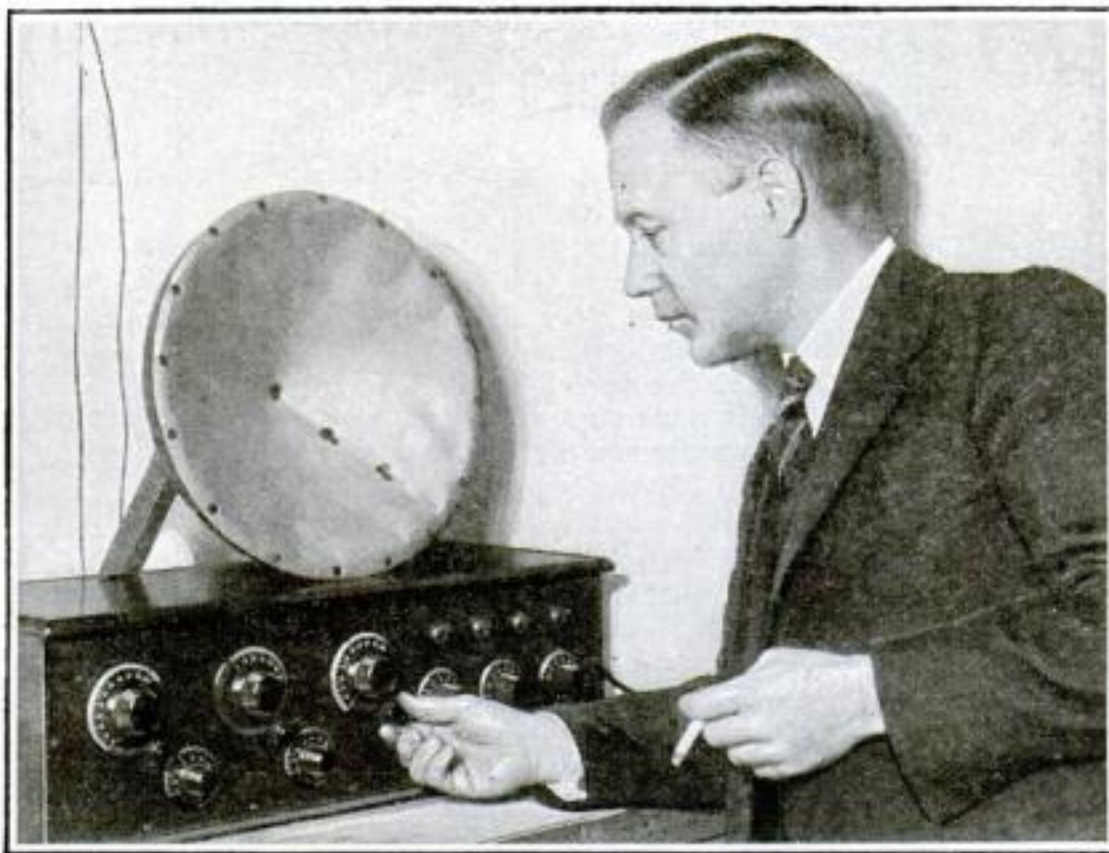
The function of a loudspeaker is to transform the electrical impulses generated in the radio receiver into sound waves in such a way that every slight variation in the electrical current will be reproduced in the form of sound. It should produce plenty of volume with minimum distortion. In other words, the music or speech should be clear and loud enough to be heard properly.

Judging of loudspeaker quality is exceedingly difficult. The human ear often conveys to the brain an impression that it has heard certain sounds that may not have been present at all. In addition, the memory of the human brain for what it has heard is extremely short. For this reason, it is next to impossible to judge the relative quality of two loudspeakers if any appreciable time elapses between the hearing of one and the other. That's what makes it so difficult to decide whether your neighbor's loudspeaker sounds better or worse than your own unless you can hear them alternately on the same receiver.

AFTER all, the true test of a loudspeaker is whether it pleases the man who has to listen to it, and on that basis you are just as good a judge as any one as to whether the loudspeaker you build is a good one or not.

All loudspeakers consist, essentially, of two main parts. First there is the electrical mechanism for changing electrical oscillations into mechanical vibrations. Then there is always the part of the apparatus devoted to impressing these mechanical vibrations on the air so that they will be conveyed to your ear. In the electrical end of the loudspeaker, a fine coil of wire is connected with the plate circuit of the last tube in the radio receiver and placed in the instrument where variations in the current flowing through the coil will change the magnetic pull of a permanent magnet. These changes, in turn, move the armature of the magnet back and forth.

In the simplest forms of loudspeaker,



Clear Reception at Extremely Low Cost

The completed homemade loudspeaker, constructed of a wrapping-paper cone, a chopping bowl, and a phonograph loudspeaker unit, at a cost of only a few dollars. You don't have to be an expert mechanic to make a good job of it. Note how the paper cone is fastened to the rim of the bowl with thumbtacks

the armature is fastened directly to the center of a paper cone.

The homemade loudspeaker illustrated is a combination of the iron diaphragm and the paper cone types.

SPEECH, as reproduced by this home-made loudspeaker, is particularly distinct. The *sh* and other sibilant sounds come hissing from the paper in fine style, and you can understand every syllable spoken by the person who is broadcasting.

The list of material you will need to build this loudspeaker is very brief. Here it is:

A—phonograph loudspeaker unit; B—wooden chopping bowl; C—paper cone; D—link wire; E and F—supporting legs, thumb-

tacks, sealing wax, etc.

The phonograph loudspeaker unit A used in the model loudspeaker was of a standard, adjustable type using a lacquered, metal diaphragm. Any of the standard units can be used at A and if you cannot secure the adjustable type, a non-adjustable unit will give good results. It is also possible to use one of a pair of head phones.

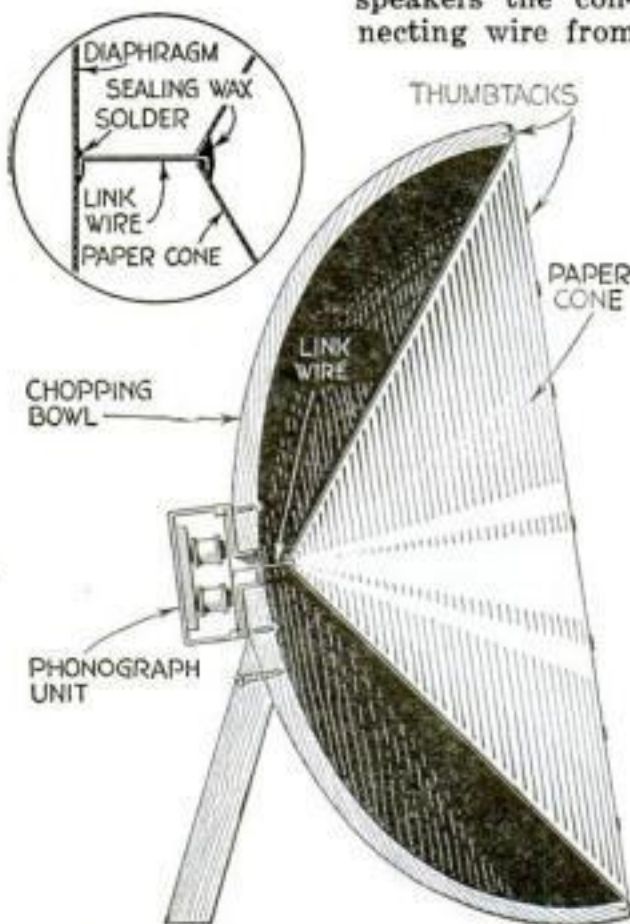
The wooden chopping bowl B should be of the largest size obtainable from your local hardware and house-furnishing store. The one used in making the loudspeaker shown in the illustrations cost 69 cents.

The paper cone C is made out of heavy brown wrapping paper. Thin paper can be used, but will not give as good results as the heavy stuff.

THE link wire D should be a piece of bare copper or brass wire not larger than No. 18 gage. Although copper wire is not very stiff, it seems to work well enough at this point, because it is so short that there is no tendency for it to bend out of shape.

The first step in constructing the loudspeaker, after you have all the parts, is to study the loudspeaker unit and find out how to take it apart so that you can get at the diaphragm. In some units, removing the diaphragm is only a matter of screwing off the cap, but in other styles the diaphragm is tightly clamped between two rings, and the cup containing the pole pieces and coils is made so that it can be moved back and forth with relation to the diaphragm.

At any rate, do your investigating



How the Parts Are Assembled

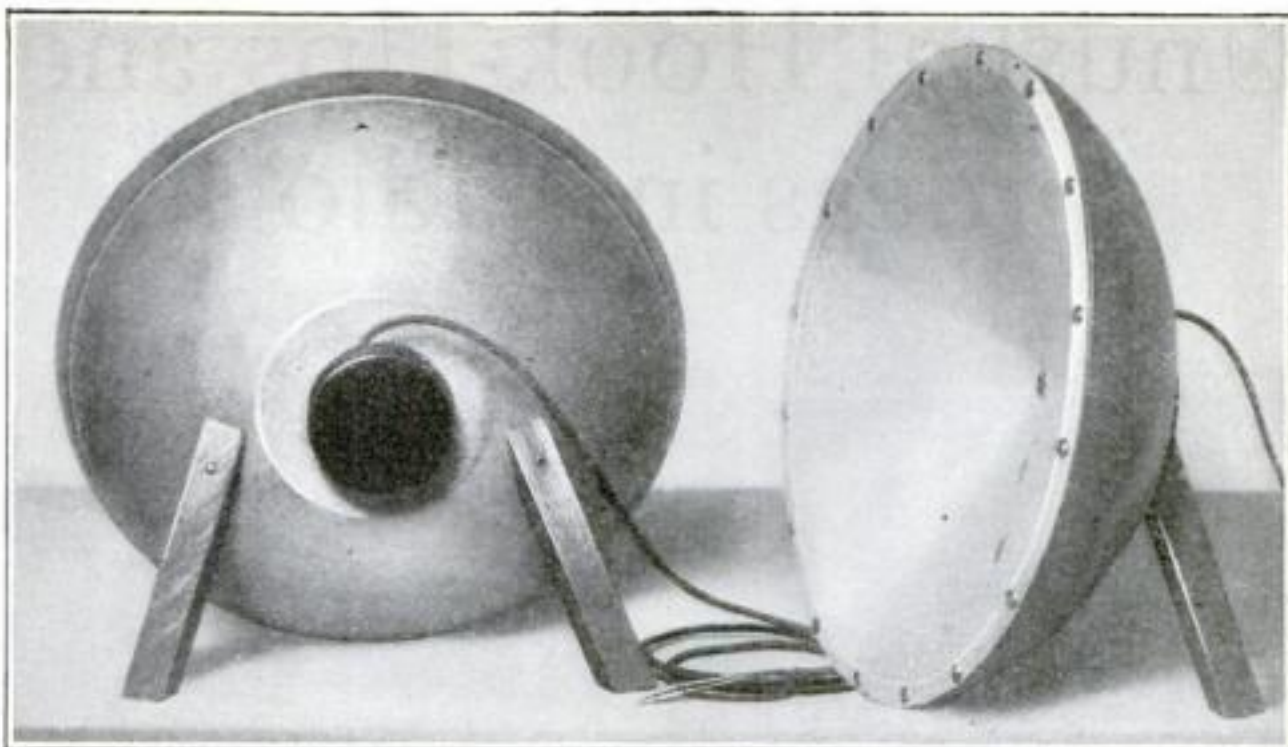
Constructional details of the loudspeaker. The larger diagram shows how the bowl, paper cone, and phonograph unit are assembled and connected. The smaller diagram shows how the link wire is soldered to the diaphragm and fastened to the cone by sealing wax

with the greatest care so as not to injure any of the parts. Do the work on a clean spot on your bench so that there will be no chance for dirt or small particles of steel or iron to get into the inside of the loudspeaker unit. Steel or iron particles are to be avoided particularly, because they stick to the ends of the pole pieces and jam between them and the diaphragm, seriously interfering with the operation of the unit. Do not try to pry the diaphragm away from the pole pieces, as this proceeding will result almost surely in bending the diaphragm. Slide it off sideways as carefully as you can.

AFTER you have the diaphragm out of the unit, scrape off the shiny black lacquer from a spot about a quarter of an inch in diameter in the exact center. The best way to do this is to use a sharp knife, with the metal disk placed flat on a clean, smooth piece of board. Do not use too much pressure on the knife, since this may result in putting a dent in the center of the diaphragm. Of course, the spot must be scraped on the side of the diaphragm away from the pole pieces. If the diaphragm of the loudspeaker unit is of the bright, tinned variety, no scraping will be necessary, for the solder will flow onto the tinned surface.

The next step is to solder the link wire *D* to the bare spot. Iron is not the easiest material in the world to make solder stick to, but you will have little difficulty if you use a hot iron and plenty of soldering paste. The excess paste can be wiped off afterward, of course. Leave the link wire several inches longer than necessary. It will be easier to hold while you are doing the soldering and it can be cut off to the proper length later on. Be sure that the wire is as straight as possible. Also, the solder joint will be much stronger if you bend about an eighth inch of the wire at right angles so that the solder will have a greater surface to hold.

Loudspeaker units for use on phonographs usually are made with a projection on the front that fits into the end of the tone arm of the phonograph. Through the center of the wooden chopping bowl *B*, bore a hole somewhat larger than the diameter of this projection so that the unit can be clamped flat against the back of the bowl as shown in the diagram on page 60. It really makes no difference what size the hole is, so long as it permits the projection of the loudspeaker to fit through it easily. The unit *A* used in the loudspeaker illustrated was fastened to the back of the



Surprisingly Simple to Build, It Gives Good Results

Two views of the paper cone-chopping bowl speaker. Notice the way in which the phonograph unit is attached to the back of the bowl; also how the supporting legs are attached. The legs are simply sticks of wood cut to the right length and beveled. The tone and volume of the speaker, of course, will depend largely on the qualities of the phonograph unit used with it.

chopping bowl by replacing two of the screws used to hold the diaphragm cover in place with long screws that projected through two holes drilled through the chopping bowl. Nuts turned down on these screws held the unit rigidly.

If the unit you purchase is not constructed in this way, or you use one of a pair of head phones, a satisfactory method will be to shape up a clamp of thin brass that can be bolted to the chopping bowl.

Clamp the unit *A* in place on the back of the bowl *B* and you will be ready to prepare the paper diaphragm *C*. This is a much simpler job than would appear at first glance. All you need to do is to cut out a circle of paper considerably larger than the diameter of the rim of the chopping bowl. Then, with the scissors, make a straight cut from the edge of the circle to the center. Be sure to use paper that has not been folded, since the creases make it difficult to form a smooth cone.

NOW lay the paper circle over the chopping bowl and push down on the center. It will form into a smooth cone shape as the center is depressed, and the edges of the paper will overlap where you cut to the center. The point of the cone should project down in the chopping bowl to within an inch of the bottom. The wire from the diaphragm can be allowed to project through the center of

the paper. Cut off the wire within an inch of the paper. Mark off where the edge of the bowl is on the paper, then remove the paper so that you can cut with scissors around the circle you have marked. Next bend over about an eighth of an inch of the link wire at right angles, being careful to keep the rest of the wire straight. Replace the paper cone in the same position it had when you marked off the circle and, after making sure that the point of the cone is centered exactly over the middle of the diaphragm, use thumbtacks to fasten the edge of the paper to the rim of the chopping bowl.

HEA the end of a stick of sealing wax with a match and let about two drops fall into the point of the cone so that the bent end of the wire is covered with the wax. Be sure that the wax is good and hot so that it will stick to the paper properly. After that you can put a drop or two along the joint in the paper as shown. This will prevent vibration.

This completes the work on the loudspeaker, and all that remains is to fit the two support legs *E* and *F*. As shown in the illustrations, these are simply sticks of wood cut to right length and beveled.

Satisfactory loudspeaker units can be purchased for about five or six dollars. The tone and volume obtainable will depend to a large extent, of course, on the qualities of the unit. The rest of the material should not cost over a dollar and results certainly will be worth while.

Have You Built Your Prize Set?

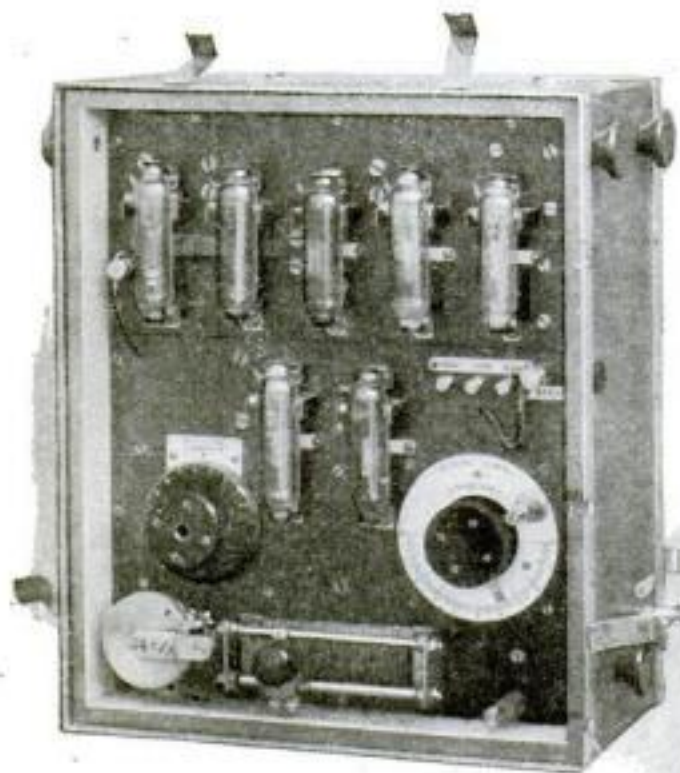
POPULAR SCIENCE MONTHLY is offering \$225 in cash prizes for the best radio receiver built to specifications set forth in our December number. You still have a whole month—until January 15, to be exact—to enter your set in this unusual contest.

Competition is open to everybody, everywhere. You don't have to be a radio expert to have a chance to win.

Rules and complete details of this fascinating contest appeared in the December POPULAR SCIENCE MONTHLY. If for any reason you missed this number, you can get a copy from your news-dealer, or you can consult one free in your public library or in any of the offices of POPULAR SCIENCE MONTHLY.

SOME of our readers may wish to know why the paper is formed into a cone shape rather than fastened in a flat sheet across the rim of the bowl. There are two reasons. One is that the cone shape makes possible a short link wire. This is an advantage, since a long, heavy wire would act as a damper and cut down the volume considerably. The other reason is that the restricted air space between the paper cone and the inside of the chopping bowl helps to keep the paper diaphragm from blasting on the high notes, a trouble that is not met with in the factory-made paper-cone speakers, because the electrical units used are built to overcome it.

Unusual Hook-Ups and Ideas in Radio



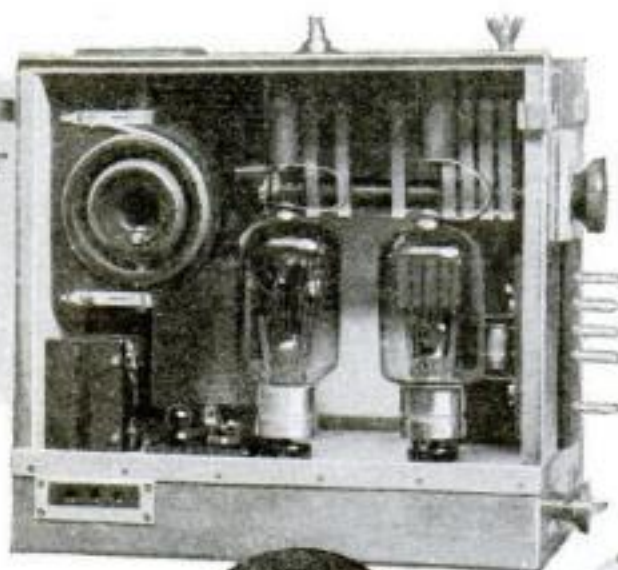
New Airplane Radio Set

Above is a very compact radio receiver designed for use on British fighting airplanes. At the right is the vacuum-tube transmitter. The wave range of the outfit is from 75 to 140 meters. Its communication range is approximately three miles, sufficient to enable all units in flying formation, as well as squadrons, to keep in perfect liaison. The complete outfit weighs 67 pounds.



Tuned by Pushbuttons

In this receiver, built by John J. Muller, electromagnets are connected with pushbuttons so that a push on any button instantly tunes the set to the station whose letters are on that button.



Revolving Top Tunes It



Instead of turning dials, you tune this receiver by revolving the top, on the edge of which is space to write the names of stations. It employs five tubes in a tuned radio-frequency circuit and will operate a speaker.

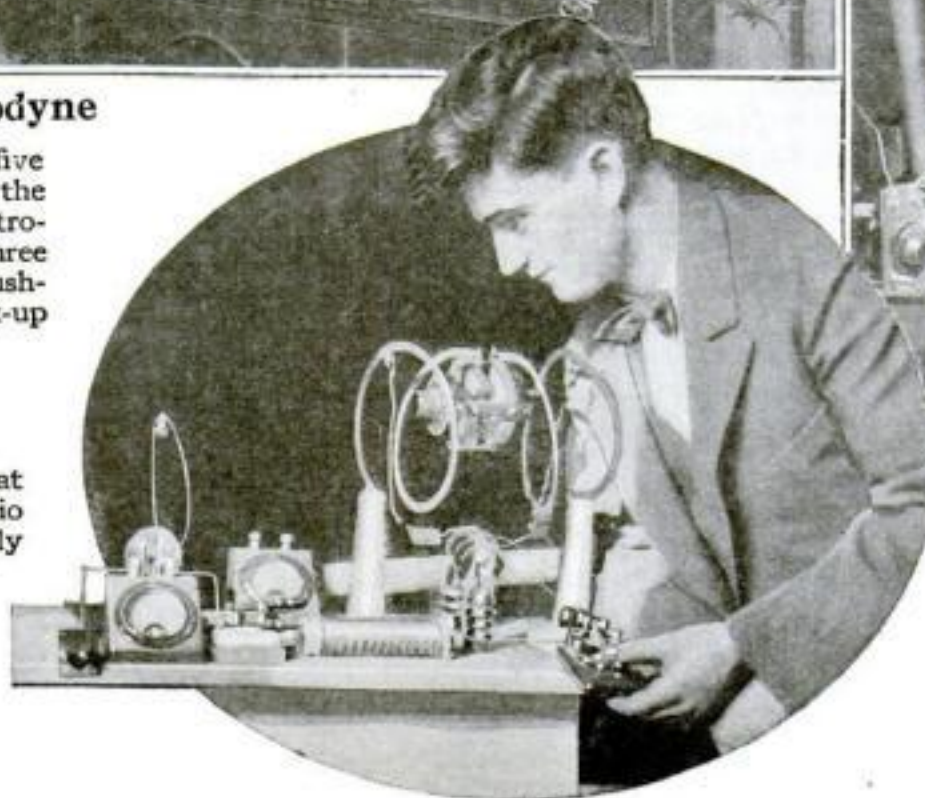


Eight-Tube Neutrodyne

In addition to the usual five tubes, George Tolley, the builder of this giant neutrodyne, has incorporated three extra tubes in a special push-pull power amplifier hook-up.

A One-Meter Transmitter

Here is a transmitter that actually will transmit radio waves on the astonishingly short wave length of one meter. For such high-frequency work, great care is necessary to eliminate all possible capacity from the circuit and to keep the connecting wires short.



He Spoke from the Arctic

John L. Reinartz, radio operator, of the *Bowdoin*, the MacMillan Arctic Expedition ship. During almost the entire polar trip he kept in touch with amateur operators all over the United States, by using a special short-wave apparatus.

What 10,000,000 People Like to Hear on the Radio

How Broadcasters Select Programs to Fit Your Taste

By John E. Lodge

WHEN you plug in the loudspeaker and begin turning the dials on your radio set, what do you want to hear? Jazz? Speeches? Music? Sport? News?

Perhaps you have no particular desires in the matter; you just sample what several stations are offering, and at last settle back to enjoy some broadcast feature that happens to fit your mood.

Many radio fans are like that; and yet so diversified is the typical broadcast program of today that one need do very little "shopping" in the ether before bringing in an acceptable feature. That is because the broadcast studio managers know exactly what you and 10,000,000 other radio listeners like to hear. They spend their time finding out what you want and trying to give it to you.

"How do you know what the listeners want?" I asked the manager of a pioneer broadcasting station.

"Well," he replied, "finding out just what our listeners want is quite a problem—there are so many of them. And it is still harder to get them what they want. For the radio audience is becoming more critical every day."

"In the early days of broadcasting, the mere novelty of the thing kept people interested. Our programs were mediocre—we couldn't get high class entertainers—and our transmission was not so good. But nobody cared. The listeners-in didn't expect real entertainment, and poor transmission didn't bother them at all. The ordinary radio receiver of those days would have reduced the best broadcasting to a mere raucous echo anyway. Just to be able to understand what the announcer was talking about was marvel enough for most radio fans, and getting distant stations meant a lot more than quality."

"But I understand that you received a lot of nice letters about those early programs," I reminded him.

"**S**URE thing!" he said. "The poorest number on one of our early programs was good for at least a basketful of mail. Most of the letters were from people who just wanted to brag about their new toy—the radio set. Nine-tenths of them



Which Feature Do You Like Best?

SINCE the beginning of broadcasting, studio managers have been studying the wishes of the radio audience with the idea of presenting features that will please the greatest possible number of people. The half-dozen sketches above illustrate familiar radio features in the order of their popularity, as indicated by letters received from fans. First come big sporting events—boxing matches, the world series, football games. Jazz music is next on the list, and classical music runs third. After-dinner speeches and similar events in which the element of humor is present is the fourth choice of the radio public. Then come morning exercises and lectures and talks

wouldn't have wasted two minutes listening to such stuff if it had come to them by some other way than by radio!

"But that mail meant a lot to us," he continued. "You see, we were in need of encouragement. Broadcasting was just an experiment then, and the mail we received was the only evidence we had that anybody ever listened to our station."

"**H**OWEVER, the experimental days are about over now. We know definitely that any station that goes on the air with a good program will have plenty of listeners. We still get letters, though, and we want them. They help us keep our finger on the pulse of public likes and dislikes and so arrange our schedules that every listener will find at least one feature on each program to his liking."

"Another important end that fan mail serves nowadays is in supplying moral support to the radio artists. Most

of them cannot visualize the vastness of their silent audience. The average listener has no conception of the feeling of hopeless futility that seizes the broadcasting artist the first time he faces the microphone. Letters, though, make the audience tangible to him, and the next time the artist appears, he is at ease and confident, because the performance is unconsciously directed to the writers of the letters."

"What is the most popular feature on your radio program?" I inquired of another prominent studio director.

"**T**HAT'S easy to answer," he said, "if you will permit me to answer it for the city man and the farmer separately. By all odds, the most popular numbers on our program as far as the city man is concerned are the reports of sporting events such as boxing matches, the baseball world series, and the big college football games. Next come the reports of big news events such as political conventions. Popular music is third; then comes classical music; after that, after-dinner speeches, political debates, and similar events. Lectures and talks of a more or less serious nature, unless they are on some subject much in the popular mind at the moment, are last on the list."



A Prima Donna at the "Mike"

Public taste in music has improved most remarkably in the last two years, say radio station managers. Above is shown Madame Frances Alda, famous prima donna of the Metropolitan Opera Company, at a recent radio appearance that scored a decided hit

"As for the farmer, the weather and crop reports overshadow everything else that he hears over the air. This is understandable, of course, since accurate weather and crop news mean dollars in the farmer's pocket.

"A really remarkable change has come in public taste in the last two years in connection with music. Jazz used to be the only kind of music the radio audience would listen to, so much so, in fact, that every time we ran through an evening without a whole lot of jazz music and popular songs, we'd be swamped with hot letters from listeners complaining against what they called 'highbrow' music.

"JAZZ dance music is still more popular than anything else in the musical line, but there has been a decided shift in the listening public's taste toward classical music, especially stringed instruments, symphony orchestras and really high class vocal selections. A few weeks ago our program for an entire day had no jazz features, yet the fan mail was just about as large and favorable as if we had given nothing but jazz music.

"And, of course, every one knows of the tremendous response that greeted the broadcasting, last season, of prominent grand opera and concert stars by way of a whole chain of stations. A phonograph company put on the programs and it is said that more than 150,000 records were sold as a direct result of one song by a well known artist.

"This season broadcasting by opera and concert stars under the auspices of a large radio company is meeting with a similar enthusiastic response."

Several other studio directors mentioned this trend of public taste in the direction of high class music. Most of them seemed unable to account for the change. One director, though, had very definite ideas on the subject.

"Why," I asked him, "are radio fans acquiring a taste for good music?"

"THAT'S easy," he replied. "Before the days of radio, millions of people never had heard enough good music to become familiar with it and learn to like it. Radio actually is educating them to demand good music. Wait a minute—" he broke off while he thumbed over a mass of letters in a special file beside his desk.

"Here you are," he said. "This ought to show what I am driving at. These two letters are from the same man. You will note by the dates that they were written two years apart. In his second letter he mentioned the fact that he had written before, and I looked up his first letter out of curiosity. Now I am glad I did."

Here are extracts from the two letters. The first was written in January, 1923, and the second, November, 1925:

The program from your station was received here last night with great



Your "Radio Eyes" at the Football Game

A football game or other sport event of national importance pleases the largest number of radio listeners. Here are Graham McNamee (with glasses) and Phillips Carlin (at microphone), announcers of Station WEA, describing the Army-Notre Dame football game at New York City

clearness and lots of volume and it was enjoyed by my family as well as several guests. We all join in thanking you for the entertainment you have afforded us. Every word of the announcer could be understood. "Somebody's Wrong" and "Tennessee" were great. That is sure some music! Give us more like that and lay off the classical stuff. It is all right for those who like it, but nobody around here does at any rate.

And the second one:

Please give my best wishes to T—S—. His violin selections last night were wonderful. My new cone-type loudspeaker seems to be particularly good on the violin pieces. I enjoyed the "Grand Opera Hour" on Thursday immensely, and hope this will be made a regular feature.



Radio Fans Insist on the Best

No matter what the feature, say the broadcasting managers, the radio audience insists these days that it be put over by an expert. That is why noted stage stars, such as Raymond Hitchcock (above), invariably please

"There's the answer in a nutshell," went on the studio director. "That man and millions more like him are developing real taste in music, and radio is responsible!"

A startling improvement in the general public's musical ear is not the only change that radio has brought. All jazz may be jazzy, but there are different ways of playing it, as some of the studio directors have found out. And the same thing applies to other popular features such as the latest sentimental love songs and comedy numbers.

"The job now is to supply really high class talent," said the studio director of one of the biggest stations.

"I NEVER heard of such a critical audience as the bunch of radio listeners who tune in on our programs. It seems to be easy enough to please them in the variety of selections. The jazz hounds like a little good music and a song now and then. And even musical critics can stand a bit of jazz dance

music. But there is one sure thing—no matter what kind of a program you give them, they'll jump on your neck unless each feature is put over by an expert. The day of 'kerosene circuit' musicians and entertainers is strictly past as far as radio is concerned. Nobody but the headliners make a hit nowadays. And by headliners I mean those artists who really know how to sing or play, regardless of whether they already have made their reputation on the legitimate stage or in concert tours."

"What about the artists who refuse to broadcast on the ground that they will spoil the sale of their services for personal appearances?" I asked.

"If any artists want to stick to that idea, that's their privilege," he replied. "They are mistaken. Radio has put many artists' names on Broadway in white lights. Before broadcasting they were hard up to get any kind of dating. The fact that the radio public is so critical is known to the theatrical booking agents, and you may be sure they keep their eyes open for new artists who make big hits with the loudspeaker audience."

THE radio audience, some 10,000,000 strong, naturally represents a pretty thorough cross section of the American people. And among so many it is certainly possible to find a desire for every form of entertainment or instruction.

"We have had requests for almost everything under the sun," another studio manager said. "But just one letter asking for a certain feature doesn't mean that we will put it on the program. It's a matter of numbers with us. When several letters come in, all asking for the same or a similar feature, we sit up and take notice, and, if it is at all possible, the requested feature is placed on the program.

(Continued on page 144)

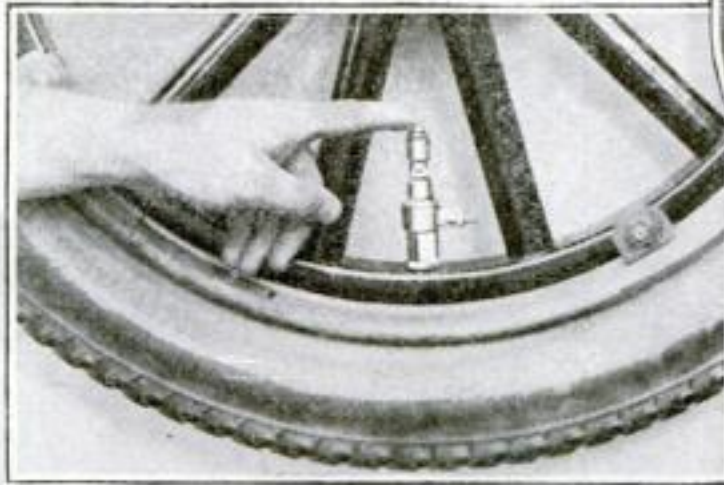
Novel Auto Fittings

Improved Tools and Handy Accessories for Motorists



Folding Tire Rim

Any motorist who has wrestled with the ordinary one-piece type of auto-tire rim will appreciate the advantages of a rim that is built in hinged sections so that it will collapse when a catch is released. It is claimed by the manufacturers that the strength of this folding type of rim is just as great as the standard types. As shown above, the tire can be removed from the rim without at all bending the rim



Whistle Signals Tire Puncture

This remarkable device is screwed on the valve stem in place of the usual dustcap. When the tire is punctured, the whistle sounds a shrill note that continues until the device is turned off

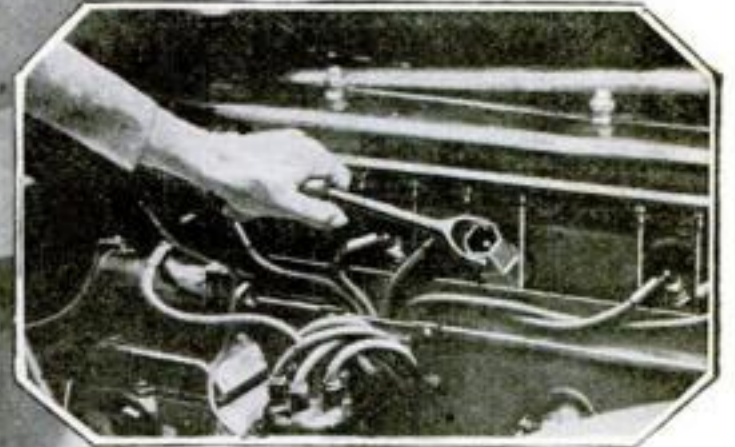
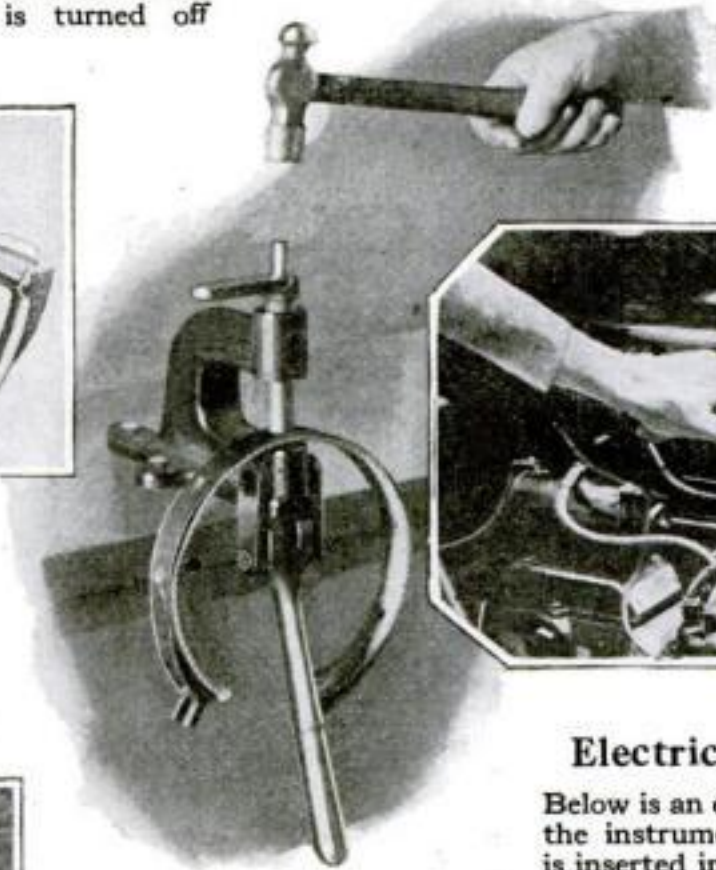


Goggles for Night Driving

These goggles for the motorist are designed to reduce glare from approaching headlights. Fin-shaped projections cut off all light from the sides. They are cut low enough so that the wearer can obtain full vision above them

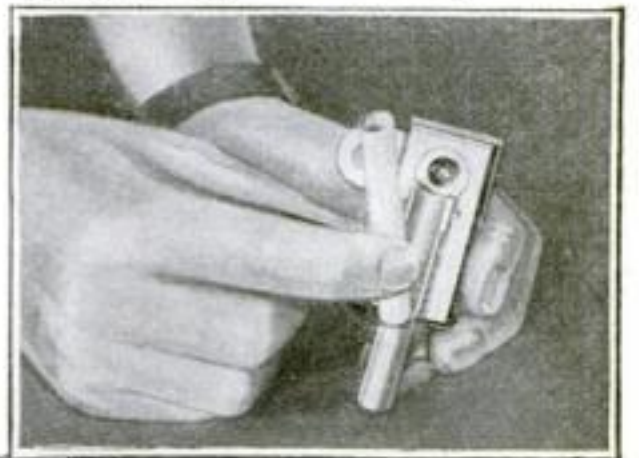
Spark-Plug Wrench

The swivel handle on the handy socket wrench pictured below makes it possible to get the spark plugs out with little effort



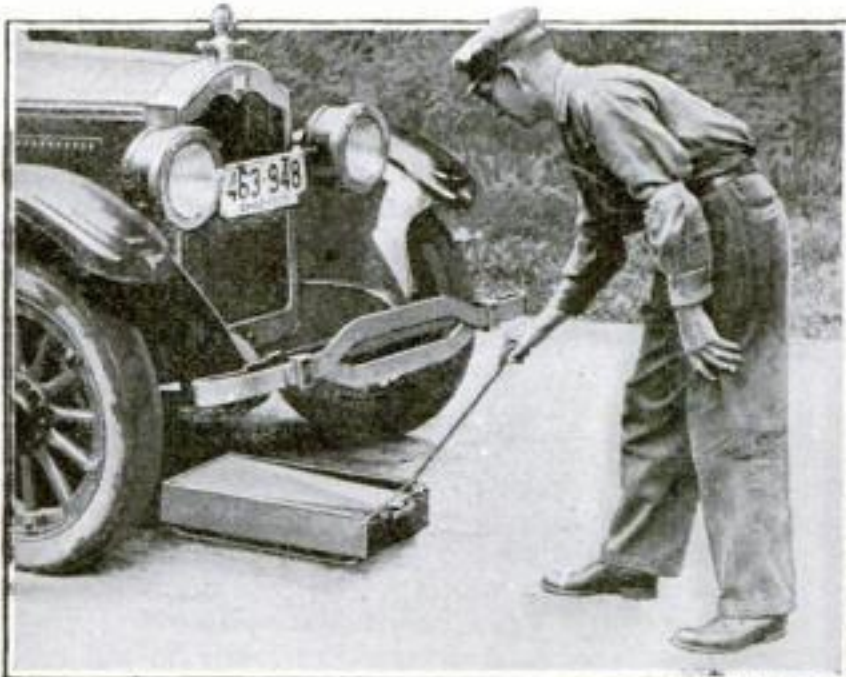
Electric Cigarette Lighter

Below is an electric cigarette lighter for the instrument board. The cigarette is inserted in a small tube. When the tube is raised, the cigarette end is quickly lighted against the heating element



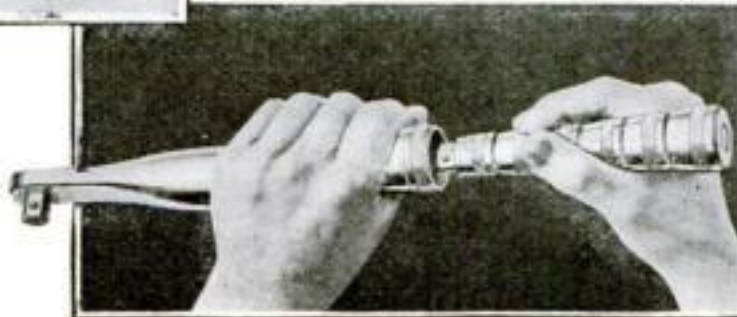
Brake-Band Reliner

Relining the brake bands on an automobile is a tedious and difficult job without the proper equipment. This novel machine can be mounted on the workbench in the garage. It removes the old rivets and then punches, countersinks, and rivets the new brake lining in place



Tank for Draining Crankcase

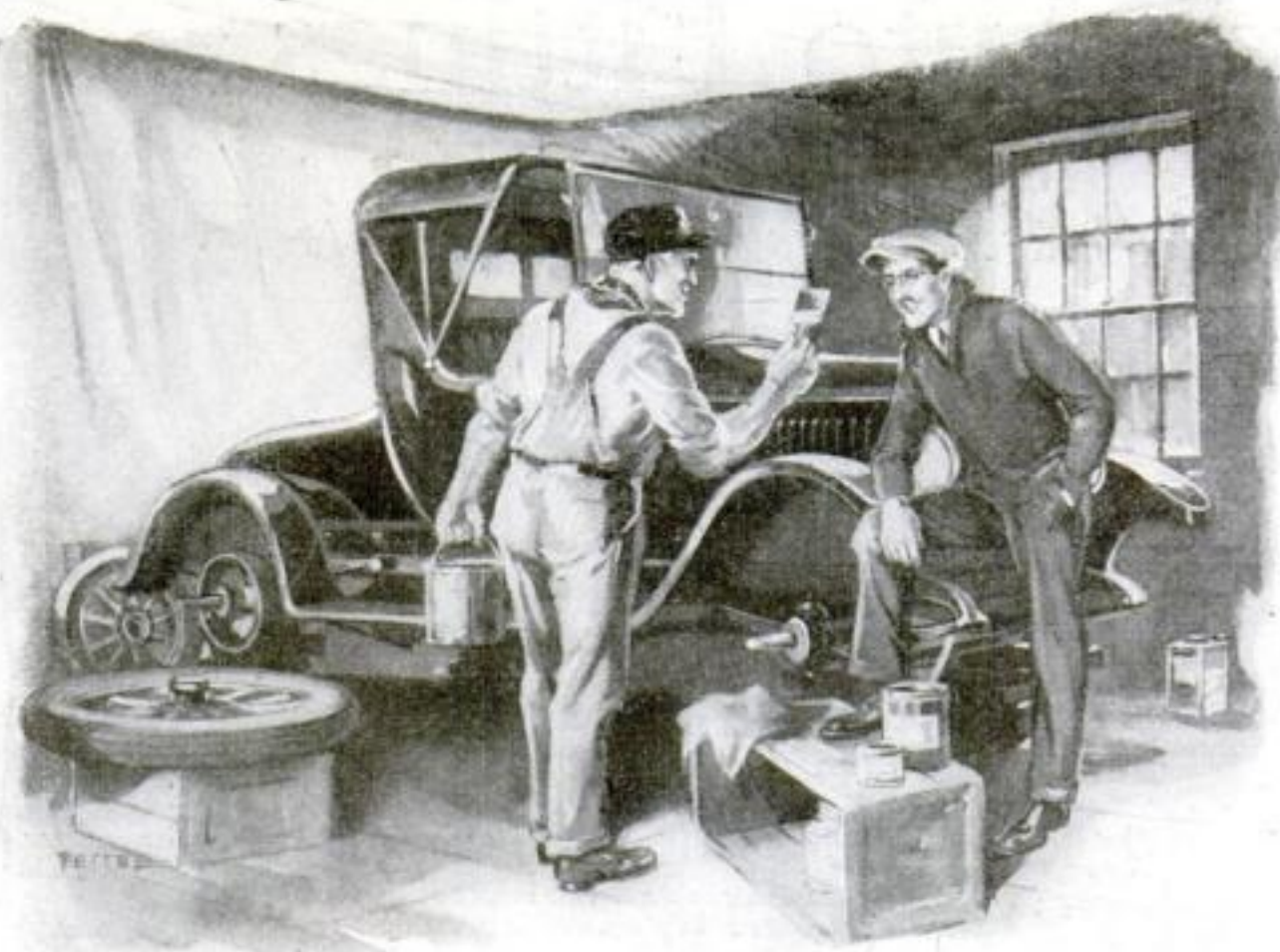
Most automobiles are built with the drain plug of the crankcase so close to the ground that it is impossible to get an ordinary pail underneath the plug when it becomes necessary to drain and refill the crankcase with new oil. This ingenious shallow tank with long flexible handle successfully solves the problem



Folding Wrench Set

This unique wrench is so constructed that the six individual sockets form into a nest that can be stowed away in the nine-inch handle. It fits hex nuts from one-half to seven-eighths inch. A seven-inch extension is included

"YOU don't have to be an expert to make the old bus shine like new," says Gus. **"All you need is good brushes, good paint, and the right dustproof place to do the job."**



In a dustproof corner of the Model Garage, Gus demonstrates to Joe why a high grade brush is important if you expect to do a fine painting job. "A 39-cent bargain sale brush simply won't flow the paint on smoothly and you have to spend half your time picking off the bristles"

How to Paint Your Own Car

Gus Tells Why It Pays to Be Fussy about Dust and Your Brush

By Martin Bunn

WHAT in blazes are you going to do with all that paint?" exclaimed Joe Clark, half owner of the Model Garage, to his partner as the latter pulled can after can out of his car and arranged them in a neat row on the workbench.

"Do you suppose I'm going to drink it?" Gus Wilson grumbled. "Read the labels on the cans if you're so durn curious!"

Joe stooped over to look at the labels more closely. "'Body Filler'—'Best Pigment Ground in Oil'—'Fine Coach Varnish'—" he read.

"I'm going to doll up this old bus so she looks like new," announced Gus. "Any objections?"

Joe smiled broadly. "It's a fine idea, all right. Your old boat looks like the moths have been making a meal out of it. But where did you get the notion that you're an auto painter? Takes an expert to do a good painting job. Just because you can fix the mechanical part of an automobile is no sign that you know how to paint the thing too. I'll bet it'll look like the dickens when you get through with it!"

"IS THAT so?" Gus growled scornfully. "Well, you just keep your eye on me now and you'll learn something."

He cast his eye appraisingly over a partly walled-in corner of the garage and then proceeded to pull out a large roll of cheap cotton cloth.

"You see, Joe, the first thing you have to figure on," Gus began, "is a place to do the job. That's more than half the battle because you can't do good painting in a cold, dusty room. I'm going to start by

closing in that corner so I can work without you or the customers shuffling up a lot of dust all over the fresh paint. Tomorrow I'm going to bring down a couple of oil stoves to keep that corner good and warm so that the paint and varnish will flow easy and dry as quick as possible."

"HUMPH!" said Joe, rubbing his chin reflectively. "Maybe you do know what you're about, after all. Come on—I'll help you put up the dust wall before I get busy with those bills."

But there were interruptions in the form of emergency repair jobs, and it was two days before the last piece of cotton cloth was tacked into place and Gus was satisfied with the arrangement.

Gus always had been in the habit of keeping his car pretty clean as well as in perfect order mechanically, but as soon as the paint room was complete he set to work to give the machine a washing so thorough that it was not finished until every speck of grease and mud had been removed from the body and running gear.

"There you are," said Gus with satisfaction. "That car is what you could call chemically pure! If you can find any dirt on that boat, Joe, I'll eat every grain of it."

"I kind of hoped I wouldn't have to take off the old paint, but now that I have it perfectly clean, I notice that it is checked and cracked in a lot of places. There are some spots, too, where the paint has chipped off and rust has started. I guess I might as well begin at the beginning and take all the paint off, right down to the bare metal."

"Phew!" gasped Joe a few minutes later as he came coughing out of his little office. "That's a gosh-awful smell you're making, Gus! What brand of paint remover is that? I never smelt anything so rank."

"You'll get used to it," grunted Gus. "I mixed it myself—half benzol and half acetone. It is kind of whiffy, I'll admit; but if you leave it on for about an hour, you can rub the paint off with an old rag or scrape it off with a putty knife."

By the next night Gus had removed the paint down to the bare wood and metal. Then he went over the car with steel wool and fine sandpaper, scraping the rust spots until the surface was smooth and even. After that he dusted it off with a piece of cheesecloth on which a few drops of varnish had been poured. This he allowed to dry till it became tacky. This process removed even the invisible dust, so Gus said.

"YOU see, Joe," he remarked, standing back and regarding his work with pride, "there's one sure thing about painting. You can't do a good job unless you put the paint on the right kind of a surface. One oily spot, or even a greasy finger mark, may cause the paint to peel off a few months later and ruin the whole job. And now I'm ready to put on the priming coat," he concluded as he busied himself with his array of cans.

"Gosh!" exclaimed Joe. "Looks as though you were setting out to do a real honest-to-goodness professional job—about 17 coats of paint."

"Not as many as that," Gus replied. "Four coats will be all that I'll have time

(Continued on page 145)

Be Your Own Boss

If you're tired of working for someone else—here's your opportunity to get into business for yourself. Be the Johnson Floor Expert in your community. We'll help you get started.

Earn \$15 to \$25 a Day . . .

There's a bigger demand every day for floor maintenance service in homes, business and professional offices, stores, schools, clubs, hotels and public buildings. In just a short time you can have a business of your own that will pay you \$15 to \$25 a day. And all you need to start is a

JOHNSON'S WAX *Electric floor Polisher*

It's the machine that insures success, independence—a business of your own. Light and easy to operate. Runs from any light socket. Simple and sturdy in construction. Nothing to get out of order. Polishes floors ten times faster and better than any other method. Gets under davenport, buffets, beds, desks and other low pieces without moving the furniture.

Investment Less Than \$50

Think of it! For less than \$50 you can have a profitable business of your own, with a high-class clientele. No more lay-offs. No more dull seasons. You'll be giving orders instead of taking them. You'll be a recognized successful business man. Mail coupon today for full information on the Johnson Floor Service Plan.

Don't Delay—Act Now

Don't put off mailing this coupon. It will mean the comforts and luxuries of life. A bank account. A home of your own. Safe years ahead.

Fill Out
and Mail
This Coupon

S. C. JOHNSON & SON, Dept. P.S. 1, RACINE, WIS.
"The Floor Finishing Authorities"

Please tell me how I can earn \$15 to \$25 a day giving Johnson Floor Service.

NAME

ADDRESS

CITY STATE

Useful Hints for Car Owners

A Novel Patch Press—Simple Remedies for Motoring Troubles

A MOST important point in making puncture repairs with cemented patches is to use plenty of pressure on the patch while the cement is setting. A short piece of board carried in the tool-kit will permit you to use your regular jack, as shown in Fig. 1, to clamp the tube and patch against the underside of the runningboard.

If your car is fitted with runningboards made of corrugated metal, it will, of course, be necessary to use two boards, placing the second board between the underside of the runningboard and the tube surface.



Fig. 1. How a jack and small board can be used against the runningboard to exert pressure on a tire patch until it is secure

THE gasoline pipe frequently gets clogged up between the main tank and the vacuum tank or, if there is no vacuum tank on the car, between the main tank and the carburetor. When this happens, it sometimes is difficult to clear out the obstruction without taking the whole pipe out of the car and attaching it to the air-pressure line.

For this reason it is a good idea to fit a petcock in the pipe line between the main tank and the vacuum tank, as shown in Fig. 2. Then, when the pipe gets clogged, the compressed-air connection can be made to the petcock. With the pipe disconnected at first one end and then the other, the obstruction quickly is blown out.

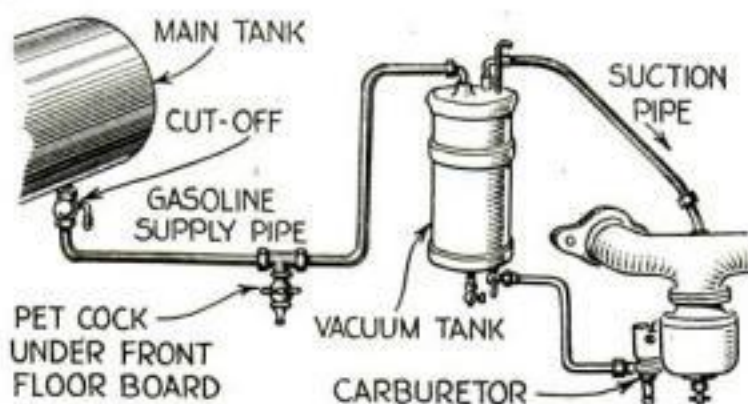


Fig. 2. A petcock fitted in gasoline pipe line between main tank and vacuum tank aids in clearing out an obstruction when the pipe gets clogged. A compressed-air connection can be made to the petcock and the obstruction blown out with little effort



Fig. 4. Above: Clamp-type battery terminal tightened with brass screw. Below: Plug terminal tightened with a lead sleeve

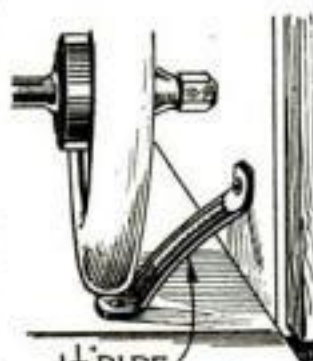


Fig. 6. Heavy pipe fastened across corners prevents the car scraping the garage door

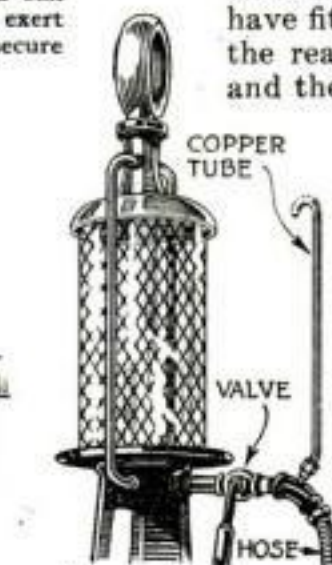


Fig. 3. A vent pipe at the outlet of gasoline pump aids in emptying the supply pipe quickly

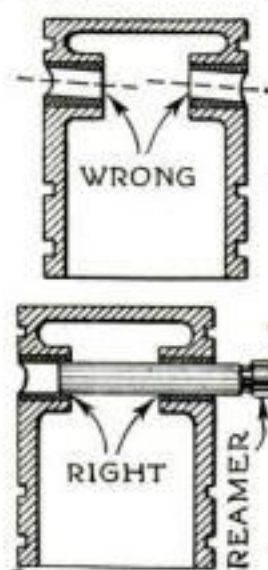


Fig. 5. Wrong and right ways to ream bushings in wristpin bearings

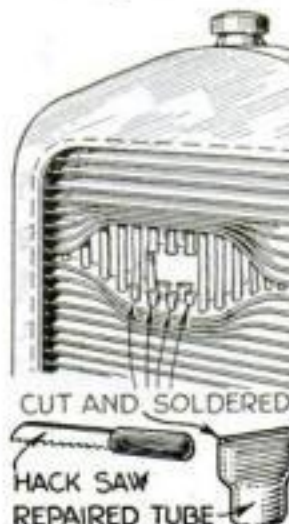


Fig. 7. Radiator repaired by cutting and soldering tubes

Fig. 4. Clamp terminals can be tightened by slotting the post on the battery with a hacksaw and screwing a brass screw into the slot after the terminal has been bolted into place.

BADLY fitted bearings cause almost as much motor trouble as poor quality oil or scanty lubrication. One point in the automobile motor that deserves careful attention is the wristpin bearing. Owners who overhaul their own cars frequently make a serious mistake in attempting to ream out the new bushings they have fitted to the pistons. They run the reamer through from each side, and the result is often as pictured in the upper illustration of Fig. 5.

A bushing fitted in this way will bind badly for a while and then will become so loose that a terrific noise results when the motor is started. The correct way to ream wristpin bushings is to replace one bushing and then run the reamer through the new bushing by way of the old one on the other side, as shown in the lower illustration. Then the latter is replaced and the process is repeated

in the other direction. Theoretically, a reamer should follow the hole, but good results only can be obtained if the reamer is guided properly. Too stiff steering often is due to crooked reaming.

MOTORISTS frequently so miscalculate the clearance in driving into the garage that the rear fender or hub cap always scrapes against the door. A simple remedy is to take some pieces of heavy pipe, and after flattening and bending the ends, fasten them at the door corners as shown in Fig. 6. They should be set at about a 45-degree angle. Then when you drive too close, the tire rides up on the pipe and slides the car away from the door so that the fender does not touch.

WHEN a vertical tube, fin type radiator becomes frozen or is damaged through collision or fan bracket breakage, leaks develop in a number of tubes. The best way to repair such an outfit is to eliminate the damaged tubes.

As shown in Fig. 7, the fins are pushed up and down until you can get at the burst tubes. These are cut off at each side of the break with a saw made out of a short piece of hacksaw blade fitted to a wooden handle. Then the ends of the tubes are squeezed flat with a pair of pliers and tightly closed by soldering. After that the fins can be pulled back into place.

If the job is carefully done, the damaged area will not be noticeable.

CERTAIN types of visible gasoline pumps are not provided with a relief valve at the upper end of the discharge hose. This greatly delays the emptying of the hose after the gasoline has flowed out of the measuring compartment.

A cure for this trouble is a vent pipe arranged as shown in Fig. 3. It consists of a length of one-eighth-inch pipe connected with the supply pipe at the point where it leaves the measuring compartment. The open end of the pipe is carried up above the top level of the gasoline in the measuring compartment so that there will be no chance for gasoline to come out at this point.

When the measuring tank is empty, air rushes into the vent pipe and causes the gasoline in the supply pipe to run quickly into the motor's tank.

POOOR connections at the storage-battery terminals often are responsible for trouble in the operation of the car.

Occasionally the trouble is caused by wear. If your terminals are of the plug type, a good way to tighten them when they are worn so loose that the nut fails to draw them up tightly, is to fit a lead sleeve over the plug, as illustrated in



ZENITH



ADLER-ROYAL



BUCKINGHAM



KENNEDY



DERESNADYNE



GLOBE



PRECEL



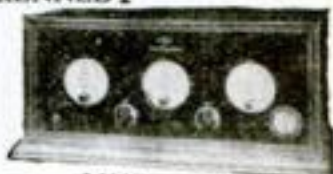
MOHAWK



PFANSTIEHL



MUNN-LANDON



MURDOCK



NEUTROWOUND



THERMIODYNE

Standard on the finest

THORDARSON

Super
AMPLIFYING TRANSFORMERS

THORDARSON ELECTRIC MANUFACTURING CO. Chicago, U.S.A.
WORLD'S OLDEST AND LARGEST EXCLUSIVE TRANSFORMER MAKERS



RADIODYNE



MERCURY



HUNTINGTON



WALBERT



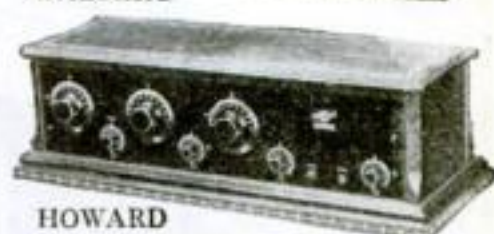
MU-RAD



WRIGHT DE COSTER



NEWPORT



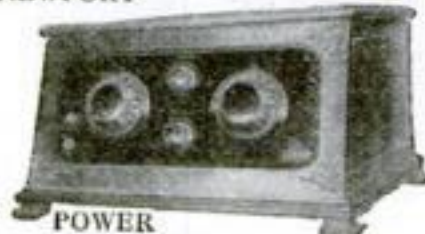
HOWARD



DRAY



HARTMAN



POWER



EAGLE



VALLEY-TONE



ECHOPHONE



AUDIOLA



SUPERIOR



ELKAY



LEICH



OZARKA

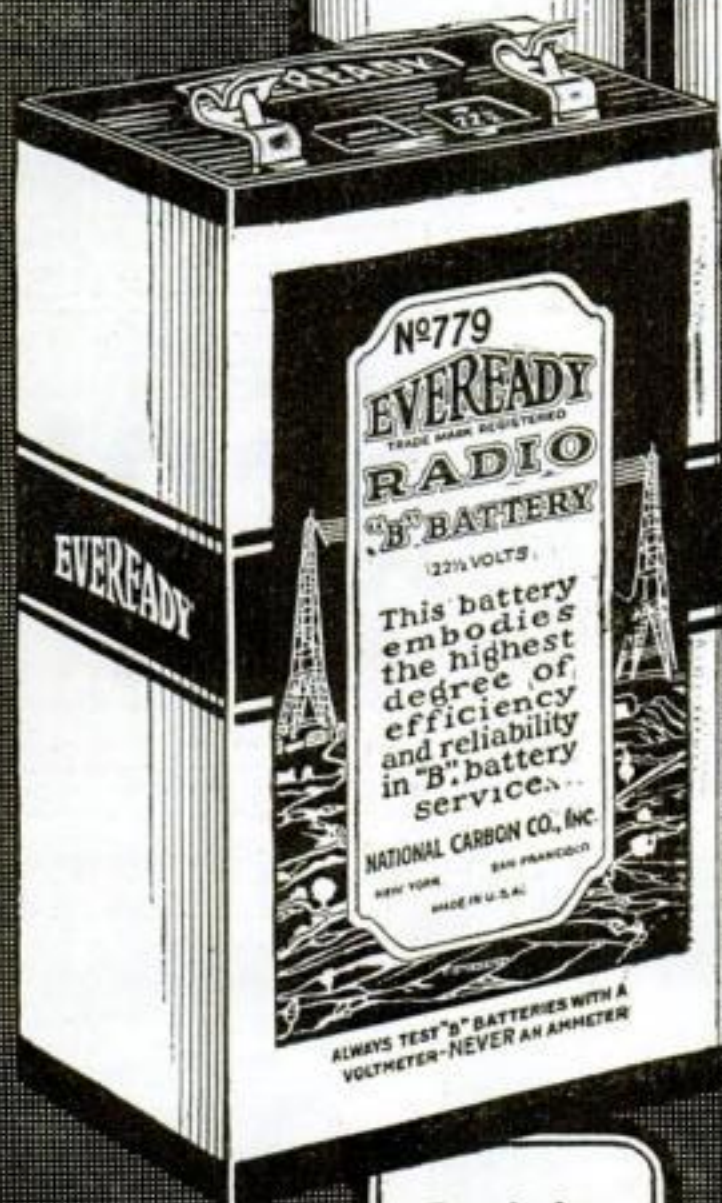


SILVER-MARSHALL



TORODYNE

Eveready
horizontal
"B" Battery
No. 766,
22½ volts,
for 1 to 3
tubes. List
price, \$2.00.



Eveready large
vertical "B"
Battery No. 779,
22½ volts, for
1 to 3 tubes,
where variable
taps are not re-
quired. Width,
4¼ inches;
depth, 3½
inches; height,
7¾ inches;
weight, 4¼ lbs.
List price,
\$2.00.

EVEREADY® No. 779

*A large vertical 22½-volt
"B" Battery*

THE famous Eveready "B" Battery No. 766, horizontal, now has a vertical brother, No. 779, 22½ volts. This has the same large cells as the No. 766, and will last as long in equal service. Being vertical, it fits perfectly the battery compartments of many popular receivers. Also valuable for use where the table or shelf space is limited.

Manufactured and guaranteed by
NATIONAL CARBON COMPANY, Inc.
New York San Francisco
Atlanta Chicago Dallas
Kansas City Pittsburgh

EVEREADY HOUR EVERY TUESDAY at 9 P.M.
Eastern Standard Time

For real radio enjoyment, tell your customers to
tune in the "Eveready Group." Broadcast through
stations—

WEAF New York	WFI Phila.	WWJ Detroit
WJAR Providence	WGR Buffalo	WCCO Minneapolis
WEEI Boston	WCAE Pittsburgh	St. Paul
WTAG Worcester	WSAI Cincinnati	WOC Davenport
	KSD St. Louis	

EVEREADY

Radio Batteries

—they last longer



The Home Workshop

Arthur Wakeling, Editor

Gumption *with* Tools

By Daniel C. Beard

National Scout Commissioner,
Boy Scouts of America

YOU will not hesitate to undertake any job in your home workshop after reading this article by Dan Beard. If you ever do have a moment of doubt, all you will need to do is to look at your kit of tools—your hammers, saws, planes, chisels, pliers, files, and all the other splendid examples of the toolmaker's art—and ask yourself: "What wonderful things couldn't a Dan Beard do with these tools?" Take the tools you have or those you can buy at the corner hardware store and use them with a little of the "gumption" Dan Beard describes, and you will find your home workshop will become a place of real accomplishment.

IN THE beautiful land of yesterday, when the writer and his compatriots were barefooted boys, perhaps none of us was rich enough to own a chest of tools; at any rate, none of us did.

The writer can well remember when his older brother gave him a gouge or half-round chisel. That gouge he used for everything except for pulling tacks. With it he made model sailboats of blocks of wood; with it he engraved his name upon all the beech trees within the circuit of eight or 10 miles from his home. He cannot now remember all the uses to which that gouge was put; but it was the only real carpenter's tool he possessed and he used it upon almost every occasion, as a half-moon scar still testifies.

What he most desired, however, was a drawknife. Alas! he never owned one; so he wrapped a rag around the pointed end of a butcher knife that he might grasp it with no danger of wounding his hand. Then, using the real handle for his other hand, he found that it was not a bad substitute for a drawknife. With this crude tool he fashioned some very shapely and effective shinny sticks and bows. With bits of broken window-pane glass or fragments of flint he smoothed the surface of his bows and arrows.

WHEN the boys of yesterday needed an awl, they did not go to the hardware store for it, because in those days boys were not supplied with a surplus of money; but they made their awls of turkey bone, hardening the bone by holding it over the hot coals until all the grease melted out, after which it was sharpened like an awl. Or, they took an ordinary "cut nail," there being no wire nails in those days, and rubbed it on the stone front steps until its edges were rounded off, and then gave it a sharp point.

Next, the head of the nail was removed, either by slowly and painfully grinding it on a stone until it was worn off, or by using an old hatchet and resting

its edge on the nail close up to the head and hammering the head of the hatchet with stone until the blade severed the head from the nail. In this way they made an awl, and when it was fitted into a wooden handle, it was an excellent tool. We used the awl for a leather punch and for various other purposes, as the occasion suggested.

As a rule we could borrow a saw with which to saw boards, or make a saw of a big kitchen knife by nicking it along its edge.

When we could not secure a saw, we cut the boards off with the axe or hatchet with which all woodsheds were furnished. We first drew a line across them from side to side, then placed the edge of the axe or hatchet on the line and hammered them with some heavy implement. By this means we gradually made a deep groove all the way across the board. Turning the board over we made another similar groove upon the opposite side, corresponding exactly in location with the first one. By carefully deepening these grooves we at last got the board so thin at that point that we could break it off with no danger of splitting; then we would take the edge of the sharp axe or hatchet and with it shave the rough edge of the board until it was smooth.

IN MY log house at Pike County, Pa., now used as the executive office of my School of the Outdoors, I have a substantial table, which we made entirely with no implement but an axe. The boards that serve for the top were cut the proper length as just described. I sometimes think that our multiplication of tools of today and our easy access to them make work so simple for us that it tends to dull our inventive power and in a measure atrophies our resourcefulness.

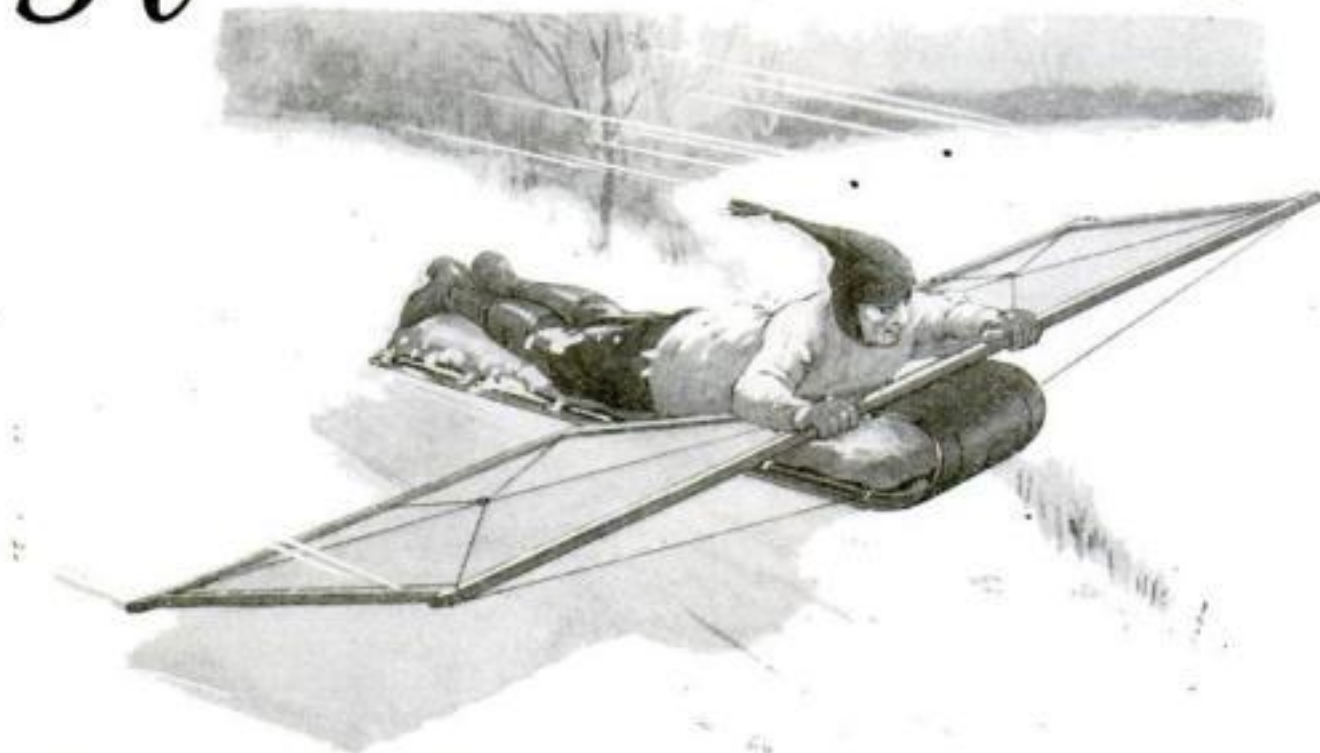
The old woodsman could build a good house and furnish it without a nail or spike or any hardware whatsoever and with no tools but his axe. Give such a man an axe, a big two-hand



Dan Beard, chief of the Boy Scouts, at 75, making a bow just as he described in "The American Boy's Handy Book," which was published in 1882

(Continued on page 95)

How We Made a Winged Toboggan



Wings fitted to a toboggan add immeasurable thrills to the sport of coasting

FROM the extraordinarily graphic pen of a New York mining engineer comes this actual record of winged tobogganing at the Sunnyside Mine, near Silverton, Colo. The altitude of this mining camp is 12,500 feet above sea level, and the winters there are from September first to July first. Snow usually falls even in July and August. The author was the chief engineer and Harley Tryon the timekeeper at this mine.

By Paul H. Keating, E.M.

PLAYING and racing with death down a 1000-foot slope of frozen snow and ice may not appeal to some as a pastime, but the palling monotony of life in a Colorado mining camp, up on the Continental Divide, where the snow is 50 feet deep and the mercury is below zero for months, makes life seem very drab. Anything with a kick in it is welcome—anything.

Two of us, Harley Tryon and myself, were the charter and sole members of the Suicide Club, builders and operators of the only amusement device of its kind ever recorded, the toboggoplane.

Tobogganing is not a slow sport in itself, but like other speed sports, each descent must be a little faster, go a little farther than the preceding, or it loses its thrill.

A toboggan on a hard frozen crust will develop a speed greater than free fall in a given vertical distance, for much the same reason that an ice boat can go much faster than the wind that drives it. It takes longer for the given vertical distance to be covered, but at the end, the actual speed down the slope is greater. The "why of" this is out of place here, but it's true.

So, when I say that we hit the bottom of the hill going more than 200 miles an hour, I know the speed is underestimated. But even this palled after a time. Keeping a toboggan upright is much like riding a bicycle, or balancing a canoe, for at high speeds a very small irregularity on the surface can have disastrous effects. Our instruction from Old Man Experience on this point came in sudden and enormous doses. But in a short time there wasn't a hill around the camp that could offer a "kick." We could ride them all to a standstill.

ONE night, after a somewhat dull toboggan party, the idea was suggested to build a set of wings on the toboggan. Maybe it would fly!

I suggested it, and Tryon said, "If you'll build it, I'll ride the thing."

From the carpenter shop next afternoon I obtained some strips of pine, some muslin (used for wrapping ventilating pipe), and some piano wire. The toboggan itself was of standard design, 18 in. wide, 9 ft. long, with a curl in front 9 in. high.

The wings of the *Dragonfly*, as we later christened the toboggan, were made of a framework of knot-free pine strips, covered with muslin, which was painted with hot paraffin to make the fabric airtight.

Two strips 1 by 2½ in. and 11 ft. long were fastened together by four cross-pieces 1 by 2½ in. by 4 ft. 3 in. Notches or mortises were cut in the longer strips to take the shorter ones, as illustrated, and a single sixpenny nail was driven into each joint from the outside.

The frame was laid on a floor and trued up with a steel square. Piano wire, about No. 22 gage, was then strung as indicated and drawn very tightly around each crosspiece and diagonally

across each section of the wing. Shingle nails driven into the strips served to anchor the wires.

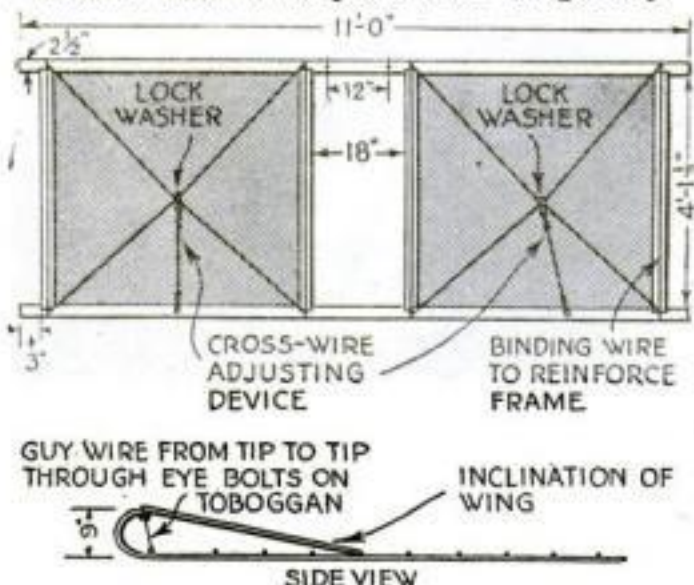
Each cross length was drawn until all gave approximately the same hum when picked. The diagonal wires also were adjusted to the same pitch by putting a lock washer around the intersection and drawing it by a wire toward the back of the frame until the tone of the wires was about even.

ORDINARY unbleached muslin was stretched over the entire frame, fastened every 2 in. with carpet tacks. The center or "cockpit" then was cut out and the loose edges tacked down. After prying the frame from the floor, to which it had been lightly nailed during the truing-up process, the muslin was painted with very hot paraffin.

Two holes were drilled in the top of the curl of the toboggan 1 ft. apart, and three turns of ordinary baling wire held the wings in place along the leading edge. The rear edge was fastened similarly to the iron eyebolts along the side of the toboggan. A continuous guy of piano wire was strung from the front tip of one wing through eyebolts in the floor of the sled to the other wing tip, and drawn tight.

The next thing was to try it. With the cushions in place, it looked every bit a dragonfly, but as a passenger carrying device, we concluded

(Continued on page 103)



A wire braced framework of 1 by 2½ in. strips is covered with paraffined muslin to form wings for the toboggan



The original *Dragonfly* after many perilous trips down a Colorado mountain side

What Will You be Earning One Year from Today?

A practical plan that is doubling men's salaries

You have said good-bye to Yesterday, with its failures and disappointments. A new Tomorrow lies ahead of you. What are you going to *do* with it?

To the man who gives little thought to his business progress, one day is much like another—filled with routine work—rewarded by routine pay. He has *no right* to expect great things of the future.

But—how different the outlook of the man who is *training* for promotion, and what a difference a mere twelve months can make in his earning power!

Give a thought, for instance, to the experience of S. N. Williams, a Kentucky man, who has specialized—with the co-operation of LaSalle Extension University—in *Salesmanship*. "My salary was practically doubled a short time ago," writes Williams, "but my greatest satisfaction comes from knowing that the amount of business I have written this year is easily five times greater than before." Williams, you see, has a *real future*—because he is constantly *preparing* for it.

Increases Salary 150%

Again, consider the experience of Arthur W. Weber, now Assistant Secretary of the Ohio Savings Bank and Trust Company, one of the largest and most influential banks in the state. One of his earlier letters reads as follows:

"Since I have been training, my salary has been increased 150 per cent. This increase is an annual return of 1,107 per cent upon my investment. Not so bad when you consider that most conservative investments net only 6 or 8 per cent. Incidentally, LaSalle training has aided me in jumping from the job of timekeeper in an automobile factory to my present position as assistant auditor of the largest and best bank in Toledo in less than eighteen months.

"There is one outstanding point about

LaSalle Extension University—it is not your excellent text-books or your well-built organization, but your willingness to help and encourage the student to succeed. It has been my experience that an enrollment with you is not a cold-blooded business proposition, but a real, cheerful, sympathetic willingness to help the student."

More recently he writes as follows: "Monthly dividends are being paid me on my investment in LaSalle training in

many, many times is evidenced by the fact that during only six months' time as many as 1,248 LaSalle members reported definite salary-increases, as a result of training under the LaSalle Problem Method, totaling \$1,399,507. *The average increase per man was 89 per cent.*

The records of these 1,248 members—representing every state in the Union and every province of Canada—are all recounted in a fascinating book entitled "A Geography of Success." The following are a few of the promotions here recorded:

"From \$110 to \$385 a month."

"Clerk to Branch Manager, at \$10,000 a year."

"Salesman to Sales Manager; salary doubled."

"From \$1,400 to \$5,000 a year."

"Passes C. P. A. examination; now partner in \$20,000 firm."

A copy of this book will be sent you for the asking. And—it's well worth sending for!

Send for Salary-Doubling Plan—Free

Yesterday is past. Let's not be hampered by it. Tomorrow is ahead of us. *Let's make the most of it!*

Below this text there's a coupon—just such a coupon

as Williams and Weber once signed, and hundreds of thousands of others who, thru home-study training, have added greatly to their earning power.

You know your ambitions. They will decide for you the training you should undertake.

You do *not* know your *capabilities*. But—they will unfold for you more wonderfully than you could dare to hope, once you begin with seriousness to fit yourself for bigger things.

Start today toward that better place, that bigger salary, by checking, signing and mailing the coupon NOW.



the form of increased salary at a rate in excess of 125 per cent per month."

You Have the Same Good Opportunity

Skeptics may suggest that the records of Mr. Williams and Mr. Weber are exceptional. And—if these men had won their advancement *without* the aid of home-study training, we should be bound to agree with the skeptics. For men are rarely promoted to positions they are not qualified to fill. When men have *fitted* themselves for advancement, however, such promotions are not exceptional at all.

That their experience could be paralleled

LA SALLE EXTENSION UNIVERSITY

The World's Largest Business Training Institution

LA SALLE EXTENSION UNIVERSITY

Dept. 183-R

Chicago

I shall be glad to have details of your salary-doubling plan, together with complete information regarding the opportunities in the business field I have checked below. Also a copy of "A Geography of Success," all without obligation.

- ☐ Business Management: Training for Official, Managerial, Sales and Departmental Executive positions.
- ☐ Modern Salesmanship: Training for position as Sales Executive, Salesman, Sales Coach or Trainer, Sales Promotion Manager, Manufacturer's Agent, Solicitor, and all positions in retail, wholesale, or specialty selling.
- ☐ Higher Accountancy: Training for position as Auditor, Comptroller, Certified Public Accountant, Cost Accountant, etc.
- ☐ Expert Bookkeeping: Training for position as Head Bookkeeper.
- ☐ C. P. A. Coaching for Advanced Accountants.

- ☐ Law: Training for Bar; LL.B. Degree.
- ☐ Commercial Law: Reading, Reference and Consultation Service for Business Men.
- ☐ Traffic Management—Foreign and Domestic: Training for position as Railroad or Industrial Traffic Manager, Rate Expert, Freight Solicitor, etc.
- ☐ Railway Station Management: Training for position of Station Accountant, Cashier and Agent, Division Agent, etc.
- ☐ Banking and Finance: Training for executive positions in Banks and Financial Institutions.

- ☐ Industrial Management: Training for positions in Works Management, Production Control, Industrial Engineering, etc.
- ☐ Modern Foremanship and Production Methods: Training for positions in Shop Management, such as that of Superintendent, General Foreman, Foreman, Sub-Foreman, etc.
- ☐ Personnel and Employment Management: Training in the position of Personnel Manager, Industrial Relations Manager, Employment Manager, and positions relating to Employee Service.

- ☐ Modern Business Correspondence and Practice: Training for position as Sales or Collection Correspondent, Sales Promotion Manager, Mail Sales Manager, Secretary, etc.
- ☐ Business English: Training for Business Correspondents and Copy Writers.
- ☐ Commercial Spanish: Training for position as Foreign Correspondent with Spanish-speaking countries.
- ☐ Effective Speaking: Training in the art of forceful, effective speech, for Ministers, Salesmen, Fraternal Leaders, Politicians, Clubmen, etc.



Name..... Present Position..... Address.....

Replacing a Window-Pane

How to Remove a Sash from Its Frame, Take out the Broken Glass, and Putty a New Light in Place

By F. E. Tustison, *Director of Science and Home Mechanics, The Stout Institute, Menomonie, Wis.*

1 Unless the window is easily accessible from the outside, the sash must be removed. First take off one of the inside stops



2 (Center) Raise lower sash slightly, pull it toward you, and remove sash cord. Tie a loop in the cord so that it will not slip into the weight pocket



3 To remove the upper sash, pull it all the way down, pry out the middle stop at the top with a chisel and remove stop by pulling out and up. The sash then is removed exactly as was the lower

The accompanying photographs were posed by Otto P. Schellinger, who is a specialist in household mechanics



4 Remove the putty with an old chisel, which should, however, be reasonably sharp. Do not expose the bare wood or repainting will be necessary before the putty will stick



5 Either use the best linseed-oil putty you can buy or mix linseed oil and dry whiting together and add about one-tenth as much powdered white lead, to give extra hardness

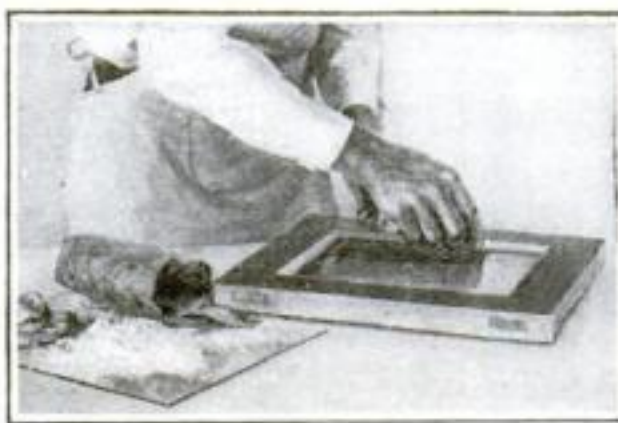
6 To make a really good job, "back-putty" the rabbet before inserting the new pane of glass, as shown in the central silhouette



7 (At right) Press the pane firmly into the back putty and drive in a few glazier's points with your chisel



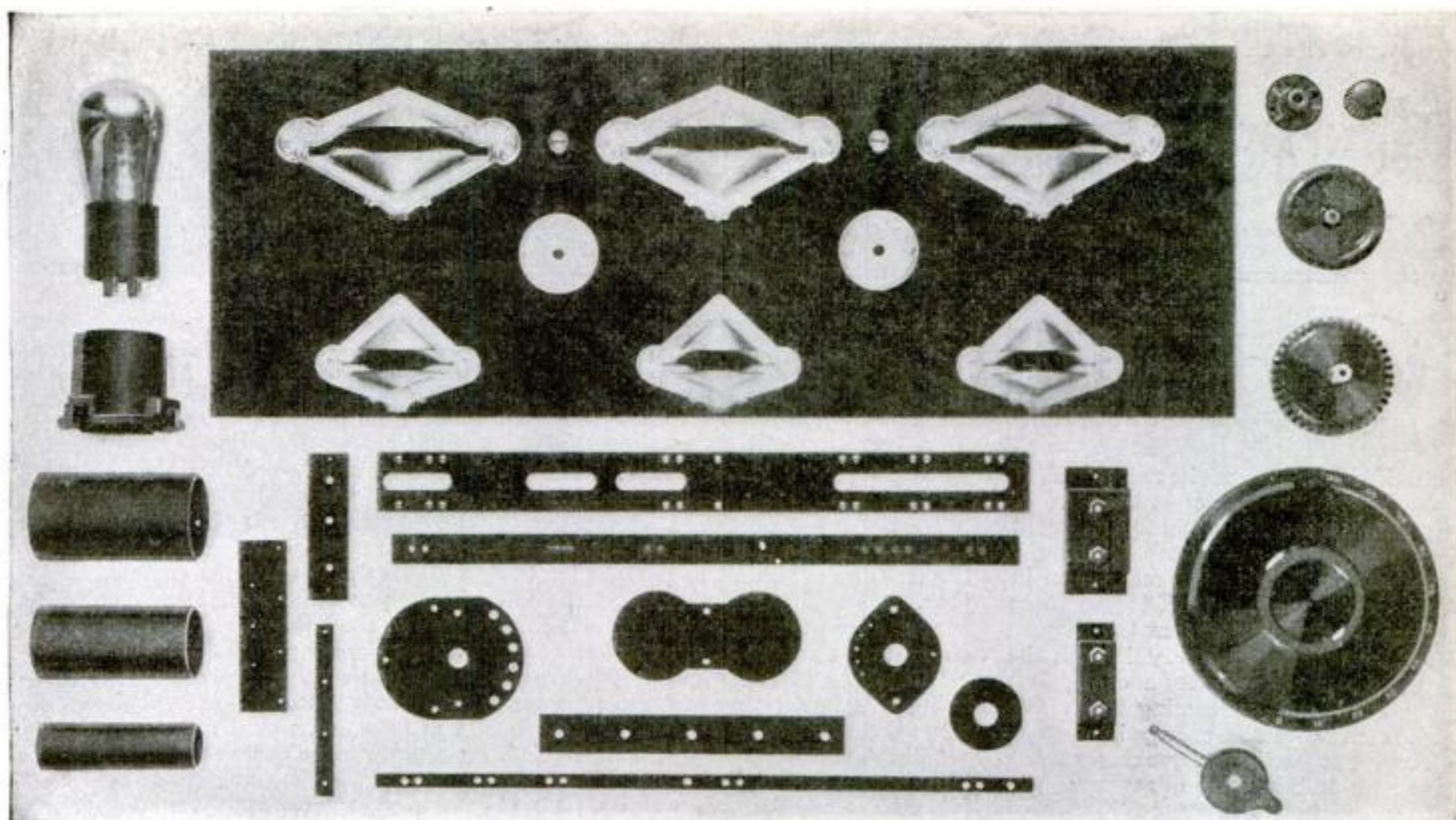
9 (At right) The experienced glazier does the job with almost incredible swiftness by feeding the putty under the knife as he draws it along the rabbet. This takes considerable practice unless one happens to fall into the trick naturally. Try it the next time you have to repair a broken light



8 (At left) There are two ways of placing the putty. Perhaps the easiest for the amateur mechanic is to roll a thin string of putty and lay it bodily into the rabbet, pressing it into place with a putty knife and smoothing it neatly with several continuous strokes from corner to corner

10 If the sash is dark green, dark brown, or any other very dark color, the work of repainting the sash can be avoided (provided the original paint is in good condition) simply by blackening the putty as soon as it is applied with a little powdered lampblack

TURN TO PAGE 78 FOR THE CONTINUATION OF THE HOME WORKSHOP DEPARTMENT



Imagine a Radio Set stripped of these parts

What a useless collection of wood, wire and metal it would be. Realizing that the parts and accessories shown here are wholly or partly of Bakelite, gives you a vivid picture of its importance to Radio.

Today Bakelite is used in a greater variety of radio parts than ever before—and the number grows constantly. This dominance of Bakelite in radio

reflects the experience and the opinions of radio manufacturers, great and small.

Radio set and parts manufacturers have every facility for testing all insulation materials and over 95% have standardized on Bakelite. This indicates how really important it is for you to make sure that the set or parts that you buy are Bakelite insulated.

Write for Booklet 25

BAKELITE CORPORATION

247 Park Avenue, New York, N. Y.

Chicago Office: 636 West 22nd Street

®

Bakelite is an exclusive trade mark and can be used only on products made from materials manufactured by the Bakelite Corporation. It is the only material which may bear this famous mark of excellence.

BAKELITE

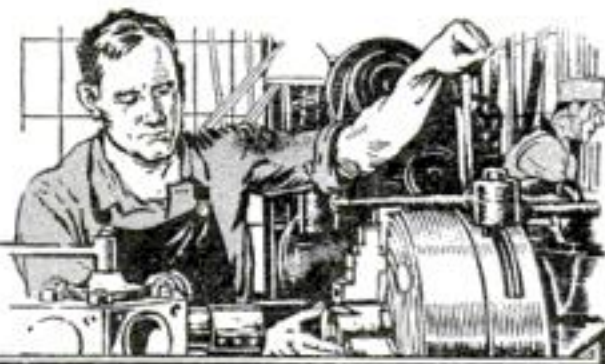
BAKELITE
is the registered trade mark for the phenol resin products manufactured under patents owned by Bakelite Corporation

THE MATERIAL OF A THOUSAND USES

® This seal on a radio or tool advertisement signifies the approval of the INSTITUTE OF STANDARDS. See page 6.

Better Shop Methods

How Expert Mechanics Save Time and Labor



Old Bill Threads a Bent Pipe

By James Ellis

Machine-Shop Superintendent

JUDGING by the cars he recognised, as he stopped his flivver in the yard of the Robinson Mill, Old Bill thought he must have been summoned to attend a convention of all the mechanical men in town. He was a bit peeved, too, as there was much work to be done at the shop.

He followed a devious way through the mill to the superintendent's office, but high pitched voices coming from the engine room made him change his course. He came upon a group looking at the engine and studying some drawings.

"There is no use talking, Joe," the mill superintendent was saying to one of his assistants. "I don't care whose fault it is; what we must do now is to correct the trouble."

"I don't believe there is anything you can get done here that will help you," Jack Watson, Old Bill's chief competitor, said. "Nobody in town can cut a thread on a 12-inch pipe bent like that."

OLD BILL joined the group, and after the usual exchange of greetings the job was explained to him. The mill had put in new boilers and piping system, and everything was coupled together all right except one pipe, the last one. It was 12-in. pipe with flanges screwed on, and this particular piece had a bend with about a 10-ft. radius that went from the steam header to the throttle valve. It was too long, or the space it should go in was too short. The consulting engineer who had laid out the plant and the men who had put it in were still arguing that point.

"It looks to me as if the thing to do is to cut-off a piece of the pipe," Old Bill remarked.

"The rest of us decided that a long time ago," Old Bill's competitor rejoined shortly.

The consulting engineer stopped his dispute long enough to say, "We do not think a weld should be permitted in this pipe."

"Can you do it?" was all the mill superintendent wanted to know.

"Yes," Old Bill said. "Get it down to the shop as soon as you can."

A wave of surprise seemed to pass through the group. "How are you going to do it?" Old Bill's competitor asked.

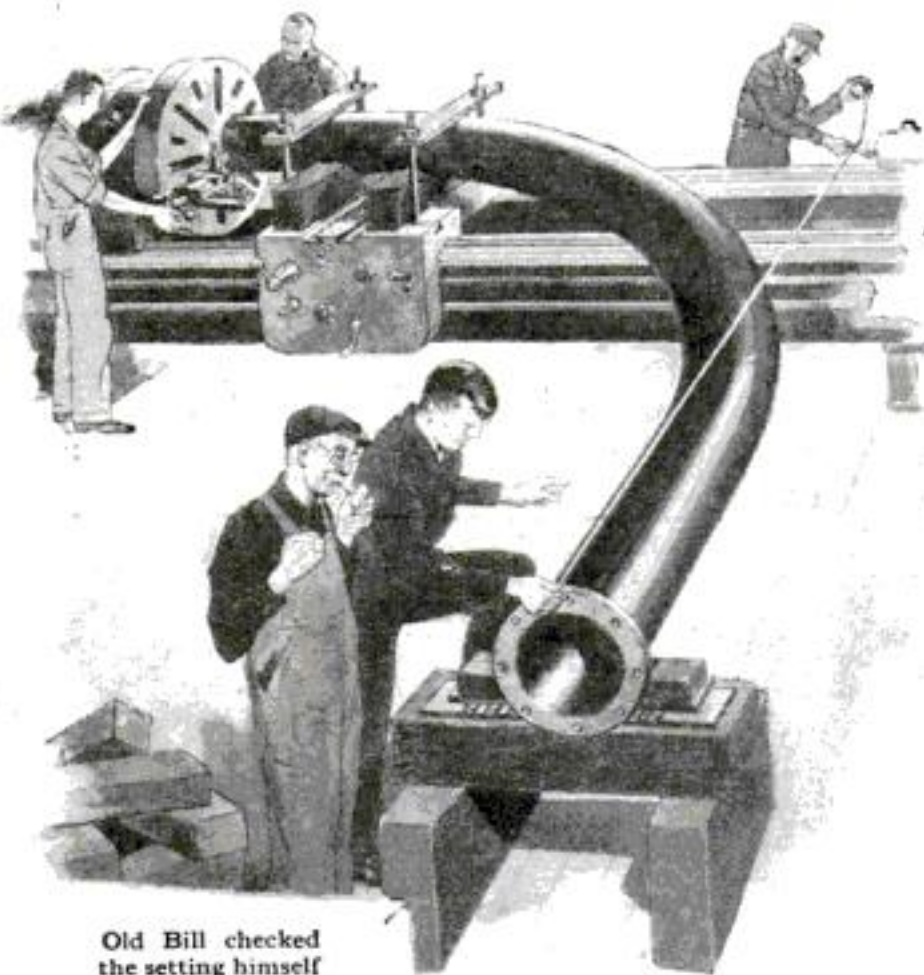
"Come down and I'll show you," was the answer, and, knowing Old Bill, every one laughed.

Old Bill realized that he had bitten off

a mouthful, so as soon as he was back in the shop he set about to prepare for the pipe. He told Bob Laten what the job was, and gave him a drawing showing the dimensions that the pipe must be.

"But, boss," Laten protested, "we can't swing this in a lathe, and the pipe machine will not take it?"

"That's all right," Old Bill replied. "We have a 36-inch lathe that will do the job. Here is what we will do. I will show you how I think we can handle it."



Old Bill checked the setting himself

Fortunately, the big lathe had room around it, and there was a small hoist overhead. Laten got a long straightedge, and, holding it on the faceplate of the lathe, he used a plumb bob to locate several points on the floor in line with the faceplate. Then he measured straight out from each of the lathe's centers and made other marks on the floor.

He had men bring in all the wood blocking they could find. Then he got a good sized angle-plate and bolted it on the faceplate. To this he bolted a full swing rest from a smaller lathe.

By this time the big pipe was being dragged into the shop. Laten had it raised and set on the lathe carriage. The other end he supported with some of the blocks.

It took a lot of straining to get the flange off the end that was to be threaded, but finally it was done. Then Laten blocked up that end so that it was about on a line with the lathe centers. He had his helper make some clamps to bolt the pipe to the lathe carriage, while he rigged up a roller support for the free end.

Truing up the pipe was rather tedious, but finally the work was located so that it was true and would roll on the blocks supporting the outer end for about 6 in.

A regular turning tool held in the toolpost attached to the faceplate was used for turning the pipe down to the correct size and taper for threading.

Old Bill came out and checked up the setting himself once more to be sure that nothing had slipped. "I think I will call up Jack Watson and get him to come over here and see how a real machine shop can do things!" he remarked good naturedly.

FOR cutting the thread the lathe was run backward rather slowly so that the tool could be fed in a little by hand at each revolution to get the proper taper. The tool was started cutting on the large diameter of the pipe and ran off the end while the lead screw fed the pipe away from the faceplate.

Old Bill figured out that the thread should decrease in size eight-thousandths with each thread, so he had Laten use the micrometer dial on the full swing rest to advance the tool this amount each time the faceplate made one

revolution. For the final cuts a man was stationed on each side of the lathe, and the tool was fed in four-thousandths at each half revolution, so that a practically perfect thread was produced by this method.

When the flange had been tried on for the last time and had been found to fit perfectly, Watson shook his head, a trifle sadly, and said: "Next time I see something that I know can't be done, I think I will slip out of the way before you come around and do it!"

MANY time-saving shop ideas are contained in the continuation of the Better Shop Methods Department, which you will find on pages 112 to 119.

Start the New Year Right!

Get the
new supplement to
the Starrett catalog



You're going to need new tools this coming year. NOW is the time to start planning.

Send for this Supplement to the Starrett Catalog. You will find it invaluable in making your selection of the tools best suited for your individual requirements.

Many fine, new Precision Tools are described in this Supplement to the regular Starrett Catalog. Illustrations—uses completely described—prices—the newest additions to the Starrett Line—it tells the whole story.

Write for it TODAY. Mailed promptly at our expense. Ask for Catalog No. 23 "W" and Supplement.

THE L. S. STARRETT CO.

World's Greatest Toolmakers
Manufacturers of Hacksaws Unexcelled
Steel Tapes Standard for Accuracy

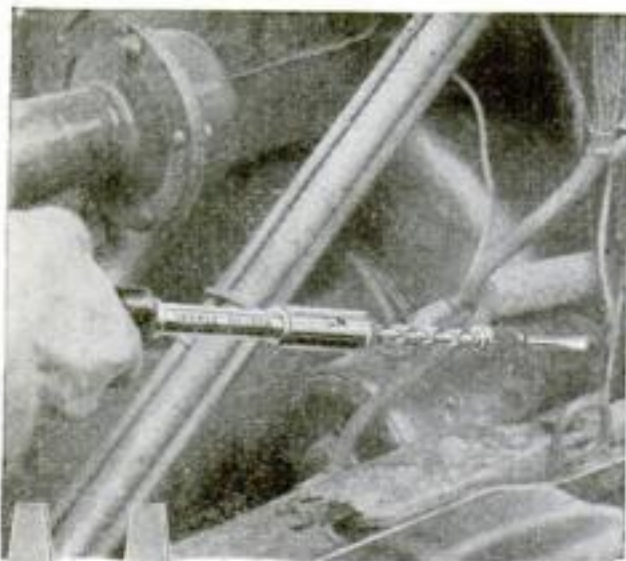


Starrett Tools



Showing how the Supplement to the Starrett Catalog describes tools and their uses. This free book has the information you want. Send for it.

8674



Removing starter screws with a "Yankee" Quick-Return Spiral Ratchet Screw-driver No. 130-A

One-handed you can quickly drive (or draw) screws in tight places.

That's where you want the "Yankee" Quick-Return Spiral Ratchet Screw-driver.

Put the blade in the screw slot. The spring in the handle holds it there.

You just push on handle.

The live spring brings handle back for the next push.

The long reach prevents barked knuckles.

"YANKEE"
Quick-Return
Spiral Ratchet
Screw-driver
No. 130-A

Right and left ratchet; and rigid. Three sizes of bits.

No. 130-A. Standard size
No. 131-A. Heavy pattern
No. 135. Light pattern

Without the Quick-Return feature, No. 30-A, No. 31-A, No. 35.

Ratchet Bit Brace
Automatic Feed Bench Drills
Ratchet Screw-drivers
Ratchet Tap Wrenches
Vises, with Removable Base

"Yankee" on the tool you buy means the utmost quality, durability and efficiency.

Dealers everywhere sell "Yankee" Tools

Write for a copy of "Yankee" Tool Book, of interest to those who love good tools.

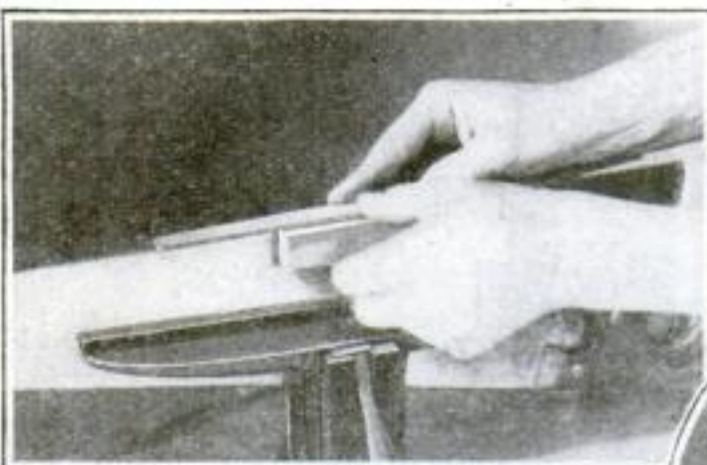
NORTH BROS. MFG. CO., Philadelphia, U. S. A.

"YANKEE"
TOOLS
Make Better Mechanics

The Home Workshop

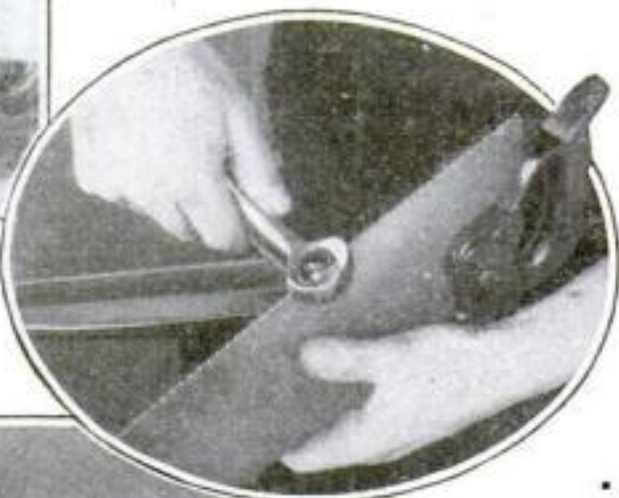
How to File a Handsaw

By Emanuel E. Ericson, *Noted Manual-Training Authority*



1 (At left) First true up the edge with a saw jointer or a flat file held on a block of wood. Take smooth, forward strokes. The edge should be a trifle convex or crowned

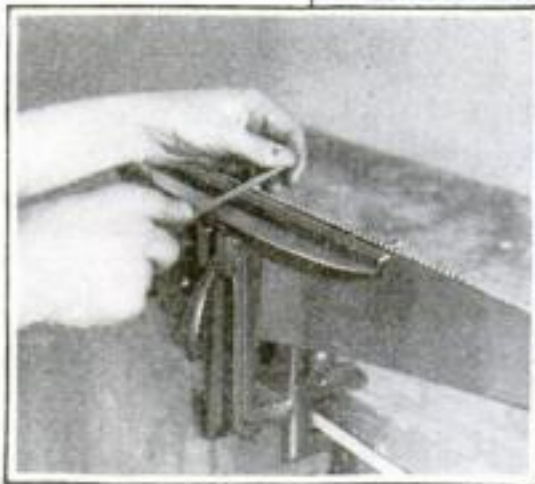
2 (At right) Using a properly adjusted saw set, bend out every alternate tooth. Then reverse the saw and set the remaining teeth the opposite way



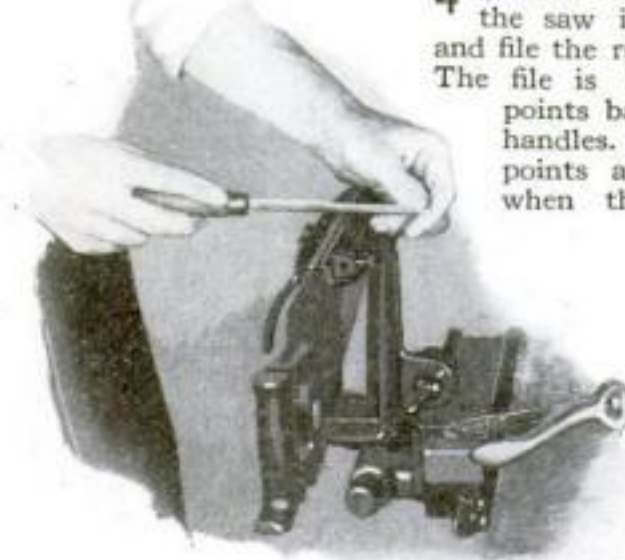
3 (At right) A cross-cut saw may either be filed against the cutting edge of the teeth or with the teeth. This illustrates the first method. Run the file in front of every tooth that points out toward you



5 (Below) When the teeth are sharp, lay the saw on a flat surface and take a stroke or two on each side with a fine oilstone



4 (Above at left) Turn the saw in the saw vise and file the remaining teeth. The file is horizontal, but points back toward the handles. Watch the points and stop filing when they are sharp



6 To file a rip saw, hold the file at right angles to the blade. Each tooth must be perpendicular on the front edge. Some mechanics prefer to lower the file handle a trifle. In either case it is well to file every alternate tooth from one side and then turn the saw. This compensates for errors

7 Straightening a kink with block and mallet. Beginners will find it a good plan to leave a few teeth at the extreme handle end of the blade untouched. It is these few teeth that will serve as a standard guide for setting and filing the saw



"Those extra bills wouldn't be there, but for my Brooks Appliance"

Does RUPTURE Cut YOUR Pay?

YOU CAN'T BE AT YOUR BEST—mentally or physically—under the handicap of rupture unless the condition is relieved by the gentle, soothing and healing restraint of a Brooks Appliance.

Throw away that old truss; free yourself of the irritation and annoyance of having to wear a steel and leather harness. Your Brooks Appliance weighs only a few ounces; elastic webbing holds a soft rubber air cushion in place, exerting an even and constant pressure, just as if it were the palm of your hand. That gives Nature a chance to repair the damage and eventually to effect a cure.

PROOF that the Brooks Appliance does heal rupture is found in the unsolicited testimony of hundreds of thousands of people in all walks of life whose letters, coming to us during the past thirty-five years, form our most cherished possession.

Send in the coupon today and you will receive valuable information on the treatment and heal-

ing of rupture in men, women and children, together with the names of many people who were cured after vainly trying other methods.

Sent on Trial to Prove It

Remember we send our Appliance on trial to prove what we say is true. You are to be sole judge. Now fill out and mail coupon—for yourself, a relative or a friend.



FREE INFORMATION COUPON

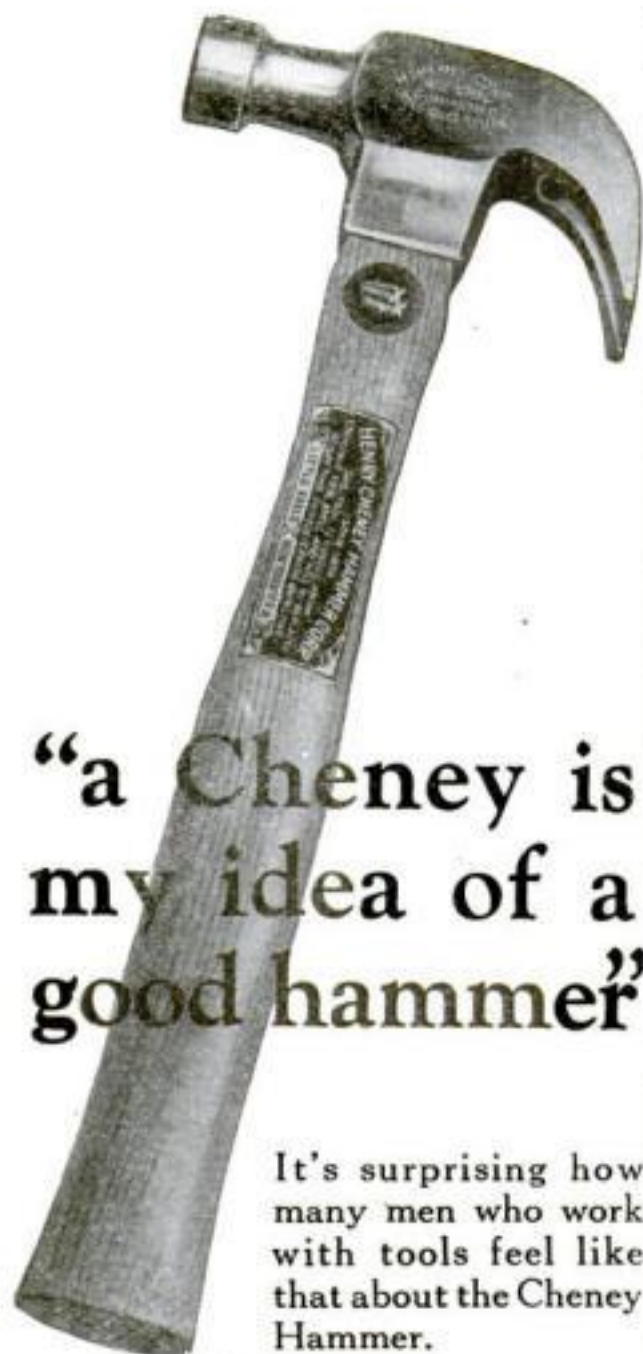
BROOKS APPLIANCE CO.,
230-C State St., Marshall, Mich.

Please mail in plain sealed envelope your illustrated book and full information about your appliance for rupture.

Name

Address

City State



"a Cheney is my idea of a good hammer"

It's surprising how many men who work with tools feel like that about the Cheney Hammer.

Some prefer it for its "Never Slip" handle, others like it for the Nail Holder in the head, others for the famous "Cheney Wedge" that keeps the head always tight. The curve of the claws, the swell of the face and the "hang" of the hammer—these things have built the Cheney reputation.

And behind everything stands almost 90 years of experience in hammer making and an absolutely unlimited guarantee that if it ever proves defective it will be replaced without charge.



The Home Workshop

Operating a Model Railroad by Electrical Controls

By James A. Baker



This is all right if you stick to commercial freight and passenger cars, but when you start building scale models, trouble is experienced in getting the longer cars through the switches.

You will see in Fig. 1, the easiest way to remedy this trouble. A standard switch is shown

WHILE many men are interested in model railways, their particular fields of activity are not all along exactly the same lines. One man will spend most of his time on the production of locomotives. Another may be interested in the rolling stock of his model railway and a third, perhaps, may tackle the problems connected with control, signaling, and operation.

In the article, "Automatic Control for Model Trains," published last month, instructions were given for making an electrically operated switch. A model track layout arranged so that all the switches are controlled by pushbuttons permits remarkably realistic operation of the model freight and passenger trains.

Before taking up the ways in which electrically operated switches may be used, there is one detail in the construction of the switches themselves that deserves special attention.

Standard track, as manufactured in this country, is made with the curved sections on a rather sharp radius. This is commercially necessary because the vast majority of sales of track are made in connection with small, popular priced, complete outfits consisting, usually, of a locomotive, two or three cars, and a circle of track with just a few straight pieces. Most of the owners of these small outfits have but limited space for a track layout—too small, in fact, for curves of large radius.

Switches, naturally, are made to the same radius as the regular curved track.

alongside one that has been altered by cutting away part of the curved section so that the cars go onto the siding, or wherever the switch leads, without so much curved track. This arrangement is particularly valuable when the curved portions of two switches are connected as, for instance, in a cross-over. I have found that switches altered in this manner

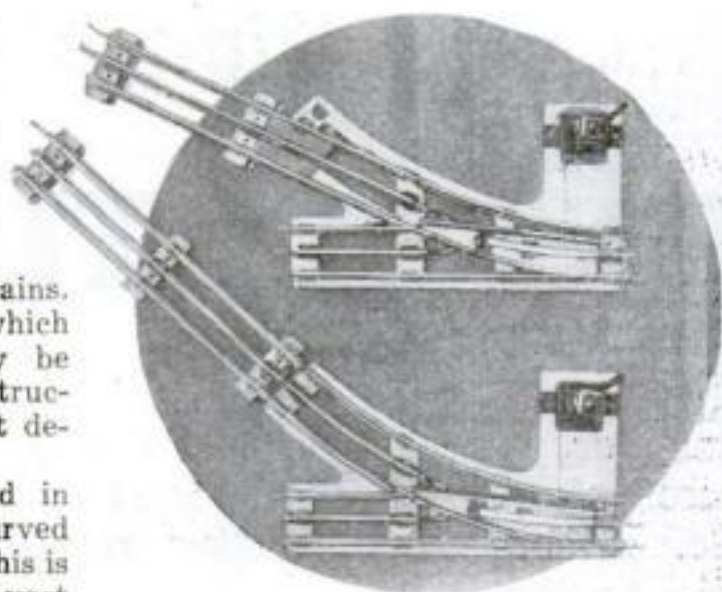


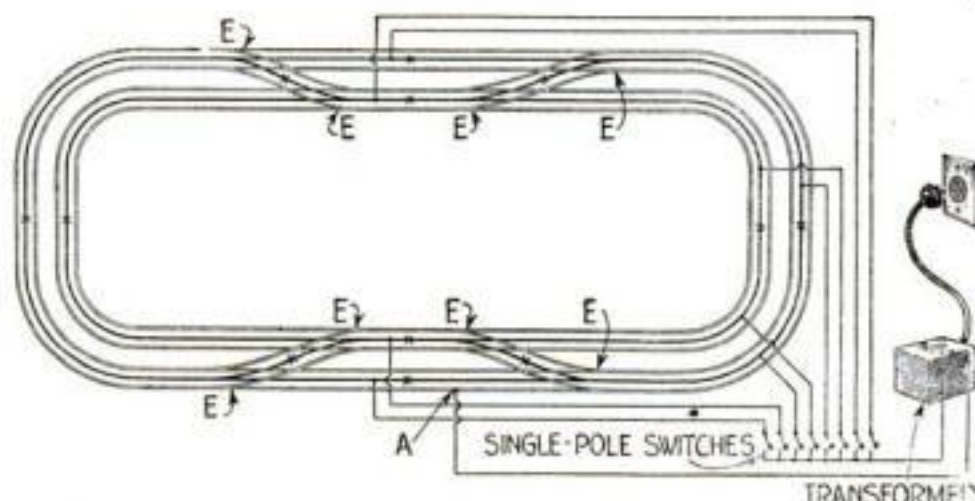
Fig. 1. A relatively straight switch for high speed train operation, and a standard switch

improve the operation of the standard rolling stock to a marked extent.

Now study Fig. 2. You will see that it shows a track layout consisting of two complete rectangles with a double cross-over on each side. Such an arrangement calls for eight switches, and if these all

(Continued on page 108)

Fig. 2. Diagram showing track layout and wiring for current control. Center pins are removed from third rail at points marked X. One wire from transformer goes to track at any convenient point on outside rails (A). The other wire from transformer goes to switches, each of which is connected independently with a different section of the third rail



The new C-H Socket for the UX tubes. Same one piece, double-grip, SILVER plated contacts used in the standard C-H Socket with the ORANGE shell. Heatproof Thermo-plax base. Genuine low-loss construction and attractive appearance.



The original radio switch—with the long life mechanism outlasts the set. Easy to mount, only one hole needed, and adjustable to all panel thickness. Can also be used in new batteryless sets.



In Radio especially— “it’s the little things that count”

A list of some of the prominent radio manufacturers using C-H products

Acme Apparatus Co.
American Bosch Magneto Co.
Astral Radio Corporation
Boisier Radio Corporation
Chelsea Radio Co.
Crosley Radio Corporation
Dayton Fan & Motor Co.
Dictagraph Products Co.
Dubilier Condenser & Radio Corporation
Electrad, Inc.
Freed-Eisemann Radio Corp.
Garod Corporation
Gilfillan Bros., Inc.
Allen T. Hamsecomb
Harding Mfg. Co.
Howard Radio Co.
The Keyport Laboratories
King Electric Mfg. Co.
Kodel Radio Corporation
LeMor Radio, Inc.
Magnus Electric & Radio Co.
Malone-Lemmon Laboratories
Glenn L. Martin Co.
Wm. J. Murdock
Newport Radio Co.
Phanstiehl Mfg. Co.
Philadelphia Storage Bat. Co.
Radio Master Corp. of America
The Radio Compak Co.
R. B. Radio Co.
Robbins Radio Co.
Signal Electric Co.
Silver-Marshall Co.
Simplex Radio Co.
R. E. Thompson Co., Inc.
J. S. Timmons
Workrite Mfg. Co.
Zenith Radio Co.

WHEN your radio set goes wrong, just as you are comfortably settled before the fireplace expecting to spend a great evening, it is annoying.

And ten to one, it's only some little wire or part that in itself is insignificant. Really, though, there's no excuse for such things happening.

GOOD parts of good material and carefully built are insurance against such annoyances.

Cutler-Hammer radio parts are GOOD parts. Both the amateur builder and the set manufacturer can attest that fact. They are designed by radio control experts, backed by 25 years experience, built of the highest quality material and sold at a price you are glad to pay.

Whether you buy or build, insist on C-H radio parts, for it's these good little parts that count and assure constant, efficient service from your set.

THE CUTLER-HAMMER MFG. COMPANY

Member Radio Section, Associated Manufacturers
of Electrical Supplies

MILWAUKEE, WISCONSIN



The closely wound, fine resistance wire is prevented from slipping or wearing out of true by a bronze spring. Thus smooth, quiet control is assured either advancing or decreasing the potential.

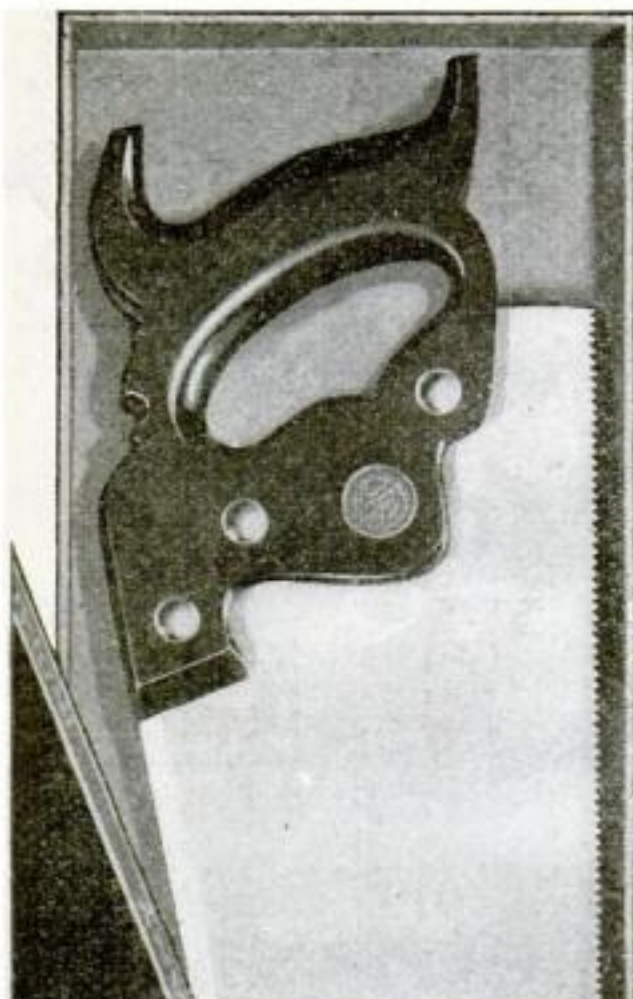
There is no jumping, no back lash; and no sticking.

While C-H Rheostats are built to engineers' specifications, they are designed for the use of the novice. They are built as a unit and are not dismantled for mounting.

Only one hole for mounting. Self centering in oversize holes and adjustable to any panel thickness.

CUTLER-HAMMER

Radio Parts for Performance



"ATKINS" The Best Gift for Real Men

Give "him" an ATKINS No. 400 Lifetime Saw this Christmas.

The moment he sees the big blue box with its beautiful saw of "Silver Steel", he will appreciate your gift. Through years of use he will treasure it because it MUST hold its edge longer and cut faster and easier than any saw he ever knew.

YOUR dealer can show you genuine ATKINS Saws. Remember—look for the ATKINS name on the blade! Write for new folder "The Saw in the Home"—sent free.

E. C. ATKINS & CO.



Established 1857

Leading Manufacturers
of Saws, Saw Tools,
Specialties and Machine
Knives.

INDIANAPOLIS, U. S. A.



ATKINS

SILVER STEEL SAWS

The Home Workshop

Sharpening Your Skates

Five Ways to Give the Runners a Keen Edge

By Lawrence B. Robbins

ALL the real fun of skating is lost if your skates are dull. Worn runners mean side slipping, uncertain footing, and consequent loss of speed in racing or during ice games. It behooves the true skating enthusiast, therefore, to keep his skates well sharpened.

The sharpening can be done at home with the aid of the few ordinary tools shown in the accompanying photographs.

Skates can be filed singly at the bench, as demonstrated in Fig. 1, by clamping the heel in a vise and drawing a good, sharp file at right angles down the blade. Care must be used, to keep the file flat on the blade. An easier



Fig. 1 (above)—Sharpening a skate with a flat file held at right angles to the blade



Fig. 3 (below)—A true edge is insured by holding the file in a slotted wood block

Fig. 2 (at left)—A safer method for beginners is to fasten a pair of skates down and file both at once

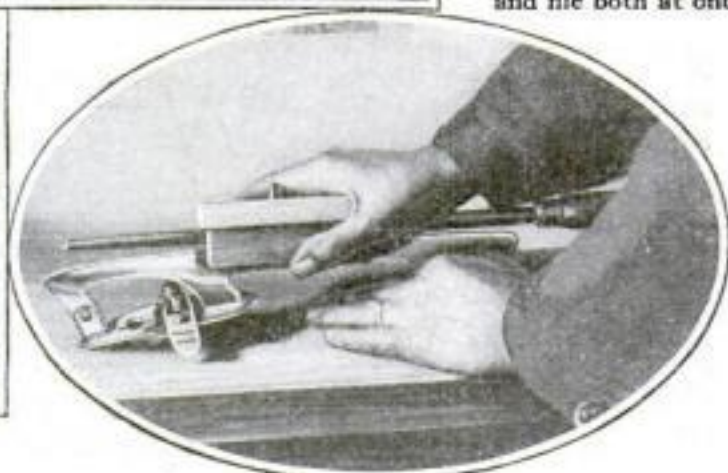
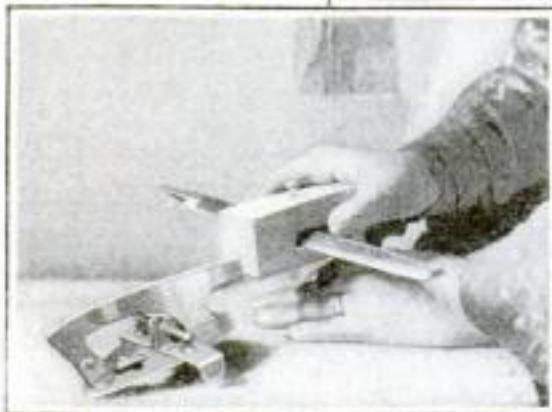


Fig. 4 (above)—It is even possible to file the runners hollow by using a round file clamped firmly in a hardwood holder

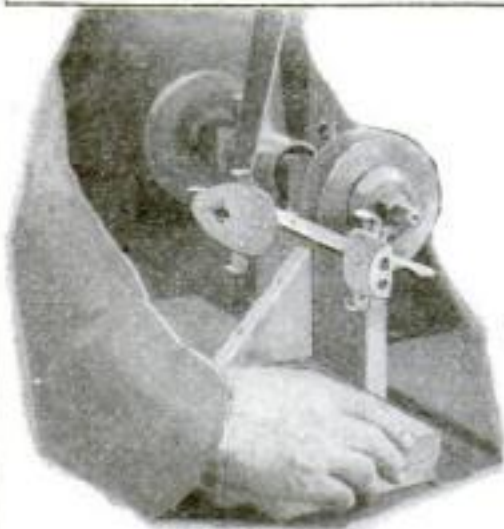


Fig. 5—Simple wooden fixture (right) for holding a skate to be hollow ground (as at left)

A device for sharpening one skate at a time is shown in Fig. 3.

It consists of a block of hard wood about $1\frac{1}{2}$ in. square and 4 in. long. If no block is handy, screw two $\frac{3}{4}$ -in. pieces together. Cut an oblong hole through the side of the block to allow a flat file to be inserted, and below it cut a longitudinal slot to fit over the skate runner. A screw in the top of the block is used to hold the file rigidly in position. Draw the skate through the slot, against the file, or fasten the skate to the bench or in a vise and draw the file over the runner, as shown.

A method of filing a pair of skates is shown in Fig. 2. Two blocks of soft wood, over which the heel clamps of the skates can be fastened, are nailed to the workbench. They should hold the skate blades parallel and as close together as possible. A third piece of wood should be placed in front of these to take the front ends of the skates. When the skates are clamped securely in position, sharpen them with a clean, flat file. Draw the file over the two runners at a slight angle and work from back to front of the runners until the edges are keen.

method of filing a pair of skates is shown in Fig. 2. Two blocks of soft wood, over which the heel clamps of the skates can be fastened, are nailed to the workbench. They should hold the skate blades parallel and as close together as possible. A third piece of wood should be placed in front of these to take the front ends of the skates. When the skates are clamped securely in position, sharpen them with a clean, flat file. Draw the file over the two runners at a slight angle and work from back to front of the runners until the edges are keen.

(Continued on page 105)

If This isn't the National Blend, - What is?

By Irvin S. Cobb

IT'S ripening time down South. On gentle hillsides where soil conditions and climatic conditions are in proper tune with each other, the tobacco—the perfect native cigarette tobacco—is ready for harvesting. Under the blazing sun the matured plants have been taking on shape and tint. The blades have been broadening, growing rich with the strength of the earth. So now workers harvest the crop from the fields, and bear it to the barns for curing.

It is cured slowly by a heat that is regulated to match the weather. The result is such tobacco as no other part of the world yields—strong in perfume, gentle in flavor, alluring in color, and in texture like taffeta silk.

* * * * *

It's thawing time up North. The drifts in the valleys of the Green Mountains are shrinking. On warm melty days there's a taste of spring in the air. The first blue-bird is back to meet the chickadees



that have been away and the melody in his red breast makes him forget the frost-bite in his toes. They have tapped the maple trees. The clear sap

drips into the pails. In the boiling pots, this sweet juice, which is the very essence of the New England groves, is being turned into firm, brown cakes. It hasn't been dosed with chemicals, nor doctored with flavoring matter or coloring matter. It hasn't been cheapened with admixtures of any coarser sweetening. It's the honest maple syrup, unadulterated and perfect.

* * * * *

This year's maple sugar, with nothing

ask Grandad
-he knows
too!

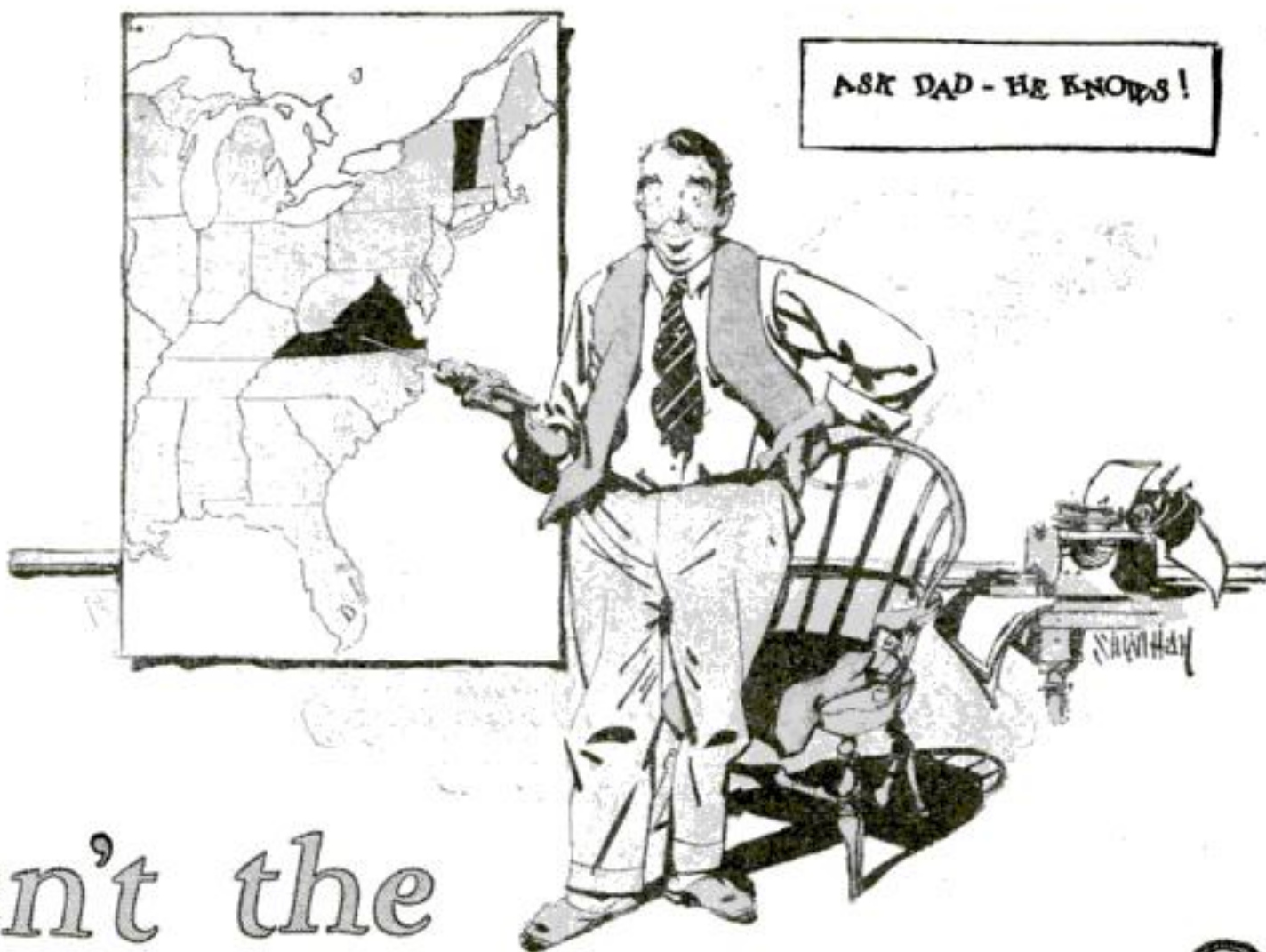


The best smokes he ever had were

"Sweet Caps"

Guaranteed by
The American Tobacco Co.

ASK DAD - HE KNOWS!



added to it and nothing taken away, is brought to where the pick of the tobacco of three years ago or four or five even, has all this time been ageing naturally. It's vintage tobacco by now.



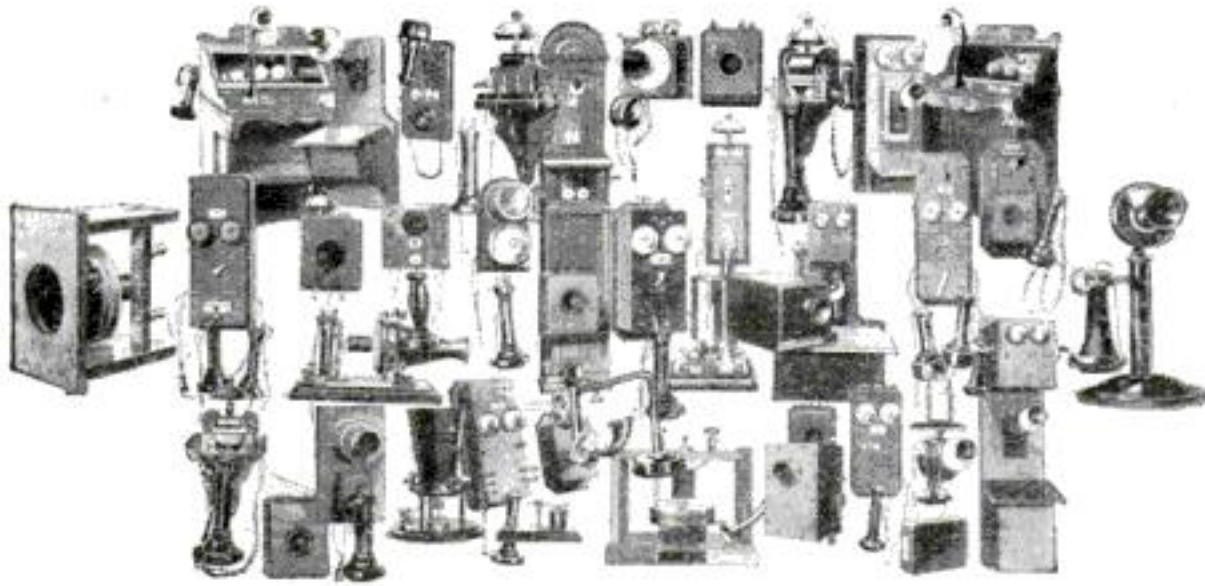
By a process which has had the endorsement of smokers all over the world for forty-seven years the prepared leaf is treated delicately with the pure sugar. That practically is all—just a mellowed, harmonious, aromatic, crusty mingling of the two F. F. V's—the Finest Flavor of Vermont, the Finished Fragrance of Virginia.

And you have the Sweet Caporal Cigarette. If Sweet Caporal isn't the true North-and-South blend, the real National Brand, what is?

Thank you.

Irvin S. Cobb

P.S.—I write an article like this every once in a while. Watch for the next. I have declined propositions to turn out advertisements for various manufactured products because I feel I merely would be a hired hand, exploiting this, that or the other thing for so much a word. But I reached for this opportunity. I knew I could put my heart in it—could with sincerity endorse the article I was praising.



An Account of Stewardship

FIFTY years ago Dr. Alexander Graham Bell was busy upon a new invention—the telephone. The first sentence had not been heard; the patent had not been filed; the demonstration of the telephone at the Centennial Exposition had not been made. All these noteworthy events were to occur later in the year 1876. But already, at the beginning of the year, the basic principle of the new art had been discovered and Bell's experiments were approaching a successful issue.

The inventor of the telephone lived to see the telephone in daily use by millions all over the world and to see thousands of developments from his original discovery.

If he had lived to this semi-centennial year, he would have seen over 16,000,000 telephones linked by 40,000,000 miles of wire spanning the American continent and bringing the whole nation within intimate talking distance. He would have seen in the Bell System, which bears his name, perhaps the largest industrial organization in the world with nearly \$3,000,000,000 worth of public-serving property, owned chiefly by an army of customers and employees.

He would have seen developed from the product of his brain a new art, binding together the thoughts and actions of a nation for the welfare of all the people.

AMERICAN TELEPHONE AND TELEGRAPH COMPANY
AND ASSOCIATED COMPANIES



IN ITS SEMI-CENTENNIAL YEAR THE BELL SYSTEM LOOKS FORWARD TO CONTINUED PROGRESS IN TELEPHONE COMMUNICATION

\$100 in Cash Prizes

See Page 4 in front of book for details

Let Boice Help You Build It!

He offers you a complete line of time-saving bench machines with higher quality and lower prices than ever before. Write for 64-page booklet containing helpful information and describing Boice-Crane Bench Circular Saws, 14 inch Band Saw, Jig Saws, Lathes, Drills, Jointers and Mortiser.

8 Inch Bench Lathe

Turns wood and soft metal. Swings 8 in. maximum over bed. Capacity 20 in. between centers. Metal-working model fitted with compound slide rest. Lathe can be fitted with jig saw, circular saw and sand disc attachments; 3 in. scroll chuck; 1/2 in. Jacob's chuck and arbor for grinding or buffing wheels.

1/4 H. P. Motor \$11.95

Standard make, new, 110 V., 60 cycle single ph. A. C. 1750 R. P. M. With cord, plug and 1 1/2 in. flat or grooved pulley. Bronze bearings.

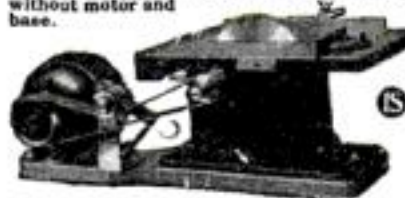
1/3 H. P. Motor \$13.95

Both motors guaranteed 100 per cent overload. This special offer not listed in regular price list. Made for immediate acceptance. Prices f. o. b. Toledo. Cash with order only. Satisfaction guaranteed. Send today.

W. B. & J. E. Boice
Dept. P. S. 1-B. Toledo, Ohio

Junior Saw

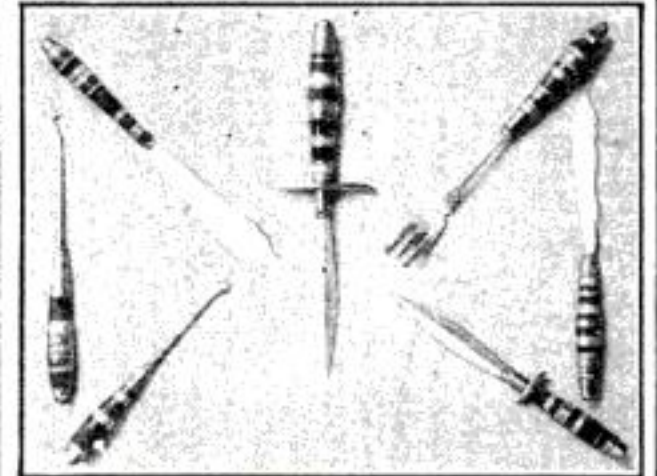
A speedy accurate machine of all-metal construction. Table 10 in. x 13 in. Saws 2 1/2 in. stock; dados 3/4 in. x 3/4 in. Cuts mouldings 3/4 in. wide. Driven by any 1/4 to 1 1/2 h. p. motor. Portable. Attaches to light socket. Attachments for grooving, sanding, grinding, drilling. Sold with or without motor and base.



The Home Workshop

Ornamental Cutlery Handles Made from Odds and Ends

IN THE winter, when my farm duties give me sufficient leisure, I make ornamental cutlery of the type illustrated below. Some are made from cold-rolled steel and others from tool steel, heated, hammered out, and dressed with a fine



From 65 to 100 washers of contrasting materials form the handles of these unique pieces

file and emery powder. The entire length of the handle end is threaded.

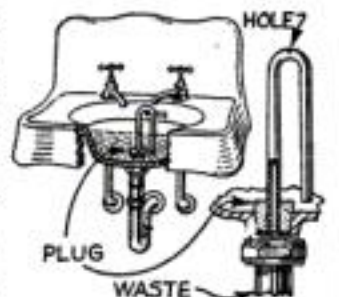
The handles are made from thin pieces of various woods, brass, copper, aluminum, and celluloid of different colors. The first piece is metal and fairly heavy. It is tapped and screwed on. The other pieces, except the one at the very end, are put on like washers. The end piece serves as a nut to draw the parts together.

The handles then are dressed and polished. The number of pieces used range from 65 to 100, depending upon the thickness.—HORACE A. MARWOOD.

Washing Photographic Prints

WITH the addition of the special stopper illustrated, the bathroom lavatory becomes a satisfactory print-washer. The water containing the hypo is drawn off from the bottom.

A wooden plug is made to fit tightly in the drainage hole. A siphon, made from a piece of copper or brass tubing 1/4 in. in inside diameter, is inserted into the plug. This connection must be water-tight. The siphon is bent so it is not quite the height of the overflow outlet, and the shorter arm is about 1/4 in. from the bottom of the basin. A small hole about 1/16 in. is drilled through the siphon at its highest point.



The special stopper

When the water is turned on slightly, the basin fills to the level of the hole in the siphon. At that point the action begins. Should the inlet flow exceed the outlet flow, the water merely passes out through the overflow, but if the water is turned off, the action stops.

A similar but larger device may be employed in a stationary laundry tub for washing quickly and thoroughly blue-prints and other large prints.

The Home Workshop

Blueprint Shows How to Build Salem Chest



DECORATIVE and beautiful as this chest of drawers is, the construction is of the utmost simplicity. There is not a single difficult joint—not even a rabbet or a groove; the case is put together like a box, with butt joints and nails, so that a beginner can build it. In that respect it is unique, for in no other piece of furniture of equal style and appearance, so far as it is known, has such an ingeniously simple method of joinery been used. The details are contained in Blueprint No. 39, listed below.

Complete List of Blueprints

ANY one of the blueprints listed below can be obtained from POPULAR SCIENCE MONTHLY for 25 cents. The Editor will be glad to answer any specific questions relative to tools, material, or equipment. Blueprint Service Dept.
Popular Science Monthly
250 Fourth Avenue, New York

GENTLEMEN:

Send me the blueprint, or blueprints, I have underlined below, for which I inclose.....cents:

No.	Title	Published	Price
1.	Sewing Table	Feb., '22	25c
2.	Smoking Cabinet	Mar., '22	25c
3.	End Table	Apr., '22	25c
5.	Kitchen Cabinet	May, '22	25c
8.	Shaving Cabinet	June, '22	25c
9.	Arbor, Gate, and Seats	July, '22	25c
10.	Porch Swing	Aug., '22	25c
11.	Bench and Tilt Table	Sept., '22	25c
12.	Electric Washer	Oct., '22	25c
13.	Tea Wagon	Nov., '22	25c
14.	Christmas Toys	Dec., '22	25c
15.	Workshop Bench	Jan., '23	25c
16.	Inlaid Radio Cabinet	Feb., '23	25c
17.	Cedar Chest	Mar., '23	25c
18.	Phone Table and Stool	Mar., '23	25c
19.	Grandfather's Clock	Apr., '23	25c
20.	Flat-Top Desk	Apr., '23	25c
21.	Colonial Desk	Apr., '23	25c
22.	Cabinet and Desk	Apr., '23	25c
23.	Pergola Garage	May, '23	25c
24.	Gateleg Table	June, '23	25c
25.	Canoe Sailing Outfit	July, '23	25c
26.	Baby's Crib and Pen	Sept., '23	25c
27.	Kitchen-Cabinet Table	Oct., '23	25c
28.	Pullman Play Table	Nov., '23	25c
29.	Toy Tea Cart, etc.	Dec., '23	25c
30.	Tool Cabinet, etc.	Jan., '24	25c
31.	Sewing Cabinets	Feb., '24	25c
32.	Chinese Game Table	Mar., '24	25c
33.	Dining Alcove	Apr., '24	25c
34.	Garden Trellises	May, '24	25c
35.	Simple Radio Cabinet	Oct., '24	25c
36.	Rush-Bottom Chair	Nov., '24	25c
37.	Simplified Bookcase	Dec., '24	25c
38.	Sheraton Table	Jan., '25	25c
39.	Salem Chest	Feb., '25	25c
40.	Desk in Sheraton Style	Mar., '25	25c
41.	One-Tube Radio Set	May, '25	25c
42.	Three-Stage Amplifier	June, '25	25c
43.	Four-Tube Receiver	July, '25	25c

Name.....
(Please print)

Street.....

City and State.....



And then he knew!

THIS was the second dance in a month, and both times the girls seemed to avoid him. And as he sat alone, hidden by the draperies, he had heard them talk about him. He decided right then what he would do about it!

* * *

A great many men are inclined to have a grimy-looking skin, spotted with blackheads and dull in appearance. Few realize that this hinders their success in life. Pompeian Massage Cream helps you overcome this handicap by giving you a clean, ruddy complexion.

* * *

Clears the Skin: Pompeian Massage Cream thoroughly cleanses the pores. It helps clear up blackheads and pimples by stimulating healthy circulation, and by keeping the skin clean and the pores open.

Easy to Use: After shaving or washing, rub it in gently. Continue rubbing and it rolls out, bringing with it all the impurities. Result—a clean, healthy skin with clear, glowing color.

Special Introductory Offer
1/3 of 60c jar for 10c.

For 10c we send a special Trial Jar containing one-third of regular 60c contents. Contains sufficient Pompeian Massage Cream to test thoroughly its wonderful benefits.

Positively only one jar to a family on this exceptional offer.

YOUR DRUGGIST HAS IT

There's nothing quite so effective as doing the job yourself. Use Pompeian Massage Cream regularly at home—then you'll get the full benefit.



The Pompeian Co., Cleveland, O., Dept. 43

Gentlemen: I enclose a dime (10c) for 1/3 of a 60c jar of Pompeian Massage Cream.

Name.....

Address.....

City..... State.....

Product of over 30 years' experience



The Favorite Voice of Radio in All Tongues

TO hear an Amplion in comparison with any or all other loud speakers is to appreciate at once why Amplions are the largest selling radio reproducers throughout the world—favorites of music lovers in all lands.

The actual originators and oldest makers of loud speakers, Alfred Graham & Co., London, England, evolved The

Amplion. Its superbly life-like reproduction and supreme clarity on all notes give eloquent testimony to Graham's more than thirty years' experience in sound reproduction.

Bring out the full musical quality of your set with an Amplion loud speaker or console unit. The prices are \$12 to \$42.50. Write for the "Amplion Pedigree" and dealer's address.

THE AMPLION CORPORATION OF AMERICA

Executive Offices: Suite M 280 Madison Ave., New York City
Canadian Distributors: Burndept of Canada, Ltd., Toronto

Associated Companies and Agents: Alfred Graham & Co., London, England, Patentees; Amplion Corporation of Canada, Limited, Toronto; Compagnie Francaise Amplion, Paris, France; Compagnie Continentale Amplion, Brussels, Belgium; Amalgamated Wireless (Australasia), Ltd., Sydney and Melbourne; British General Electric Company, Ltd., Johannesburg and Branches; Indian States and Eastern Agency, Bombay and Calcutta; C. J. Christie E. Hijo, Buenos Ayres; David Wallace & Co., Valparaiso; Mestre & Blatge, Rio de Janeiro; F. W. Hammond & Company, London and Tokio.

AMPLION

FARAWAY RADIO \$22.50



Gets stations Far and near Loud and Clear

FARAWAY Radio Sets are amazing values at bargain prices. Users get stations from New York to Frisco—loud and clear. Operate with either dry cells or storage batteries. Beautiful cabinet finished in mahogany with new platinum finished panel. SATISFACTION GUARANTEED. Don't pay \$100 to \$150. Write for our money-saving plan and literature.

2 Tube Set—\$22.50
5 Tube Set—\$63.50

Dealers—Agents: Biggest possibilities you ever heard of. Write for plan and territory quickly.
The Faraway Radio Co., P.O. Box 819, Dept. U 2, Cincinnati, O.

Earn \$12⁵⁰ a Day!

That's What Kulp of Ohio Averages



Sell Glasses

Famous True Fit Spectacles Highest Quality

Largest manufacturer in world selling spectacles direct through agents. Write for BIG NEW PLAN. Million dollar concern just going into the Agency Field.

True-Fit Optical Company
Evans Bldg., Sta. C, Dept. T-147, Chicago, Ill.

The Home Workshop

Could You Whittle a Broom with Your Pocket-Knife?

By Herbert I. Childs

FOR one who has a keen pocket-knife and knows how to use it, it is no trick at all to whittle a whisk-broom. It is a good project for the whittler to try occasionally, when he has an odd half-hour to spare, as a test of his ability to make clean, thin, slicing cuts, and it makes a neat demonstration by which the home worker can display his virtuosity with a penknife.

There are so many kinds of wood one may choose that it is difficult to say what kind is best. That used for making the broom illustrated was white birch.

Have the stock free of knots, about 16 in. in length and perhaps 1 1/4 in. in diameter. Allow plenty of room at one end so that you can hold the stock firmly.

Start about 6 in. from one end, cutting with the grain. Cut a strip about 8 in. in length, stopping about 2 in. from the other



Two stages in making wooden whisk-broom

end. Cut as many more as you can, going completely around the stick. These you must bend backward and hold against the bottom end of the stick. Then repeat the operation until you have cut enough to make a broom of the size you wish. The slivers then should be bound tightly against the 2-in. end of the stick. Cut off the handle to suit the fancy and trim the brush end evenly.

THIS is the third article by Mr. Childs, one of the foremost authorities on whittling. The first appeared on page 80 of the September, 1925, issue and the second on page 82 of the October, 1925, issue.

Splicing a Broken Torque Tube

WHILE working on a portable saw-mill, the torque tube of my Ford truck broke. As no replacement was to be had, I made a temporary job by cutting a piece of 2 1/2-in. pipe about 10 in. long



Repair made with pipe and rivets

and placing it in the end of the broken tube. Holes were drilled through both tube and pipe. A shaft was placed inside the pipe, and pipe and tube were riveted together with rivets made from large spikes. The remaining piece of torque tube was forced over the protruding end of the pipe and riveted solidly in the same way.

—OSCAR M. ANDERSON.

The Home Workshop

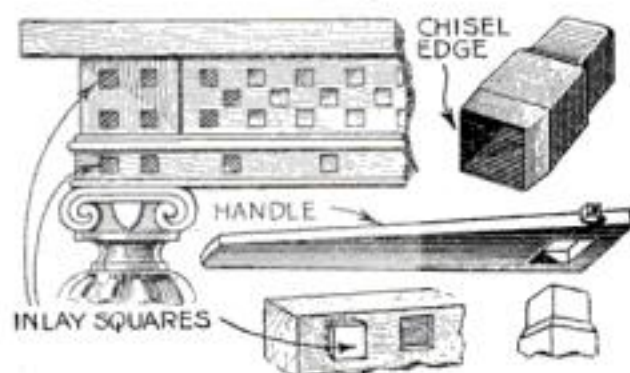
Quick Method of Making Inlays

By Roy L. Gerding

INLAYING homemade furniture generally is considered by the amateur woodworker to be a tedious and somewhat difficult job. I have been experimenting with various methods and have developed an effective way to make inlays that does not take much time.

You will need four or five chisels of special design. These are made from square and hexagonal socket wrenches of different sizes. For $\frac{1}{4}$ in. back the lower edges should be ground or filed to about the thickness of a hacksaw blade. The edges then should be ground like chisels and honed as keen as possible on an oil-stone. A handle of some sort should be made for these hollow chisels, a simple type being illustrated.

The inlays are cut from pieces of wood planed to $\frac{1}{8}$ in. or less or from scraps of thick veneer, if available. The cutting should be done on a heavy block of wood



Hollow chisel made of socket wrench, the chisel handle, and the simplest type of inlay

sawed squarely and placed end up. A punch is needed to knock the inlays out.

The recesses for the inlays are outlined with the same chisels and the waste wood is removed either with an ordinary chisel, a bent woodcarver's chisel, or a chisel made from a broken hacksaw machine blade or an old file.

When the inlays have been fastened in place with the best grade of liquid glue, they can be planed and scraped flush with the surface or allowed to project a trifle to give a relief effect, as in the overlays that are now so popular.

This method of inlaying is adapted especially to designs of odd or Oriental variety. A surprising number of patterns may be made by combining the pieces cut by different tools. It is well to draw a few combinations before deciding on the one to use for ornamenting any particular piece of furniture.

An Oriental table may be made by enameling the wood jet black and ornamenting it with inlays colored pearl gray, enlivened in places with touches of blue. The blocks are painted with artist's oil colors, which come in small tubes. The painting should be done before the blocks are inlaid and the colors later given a protective coat of clear varnish.

This method of inlaying can be used to advantage on radio cabinets, footstools, chairs, and many similar articles.

When y-o-u buy **BROWN & SHARPE** Tools

on *Utility* alone

you are buying for the same reason that all classes of mechanics prefer these fine *Quality* tools the world over - - - - - because the tools *profit* the user

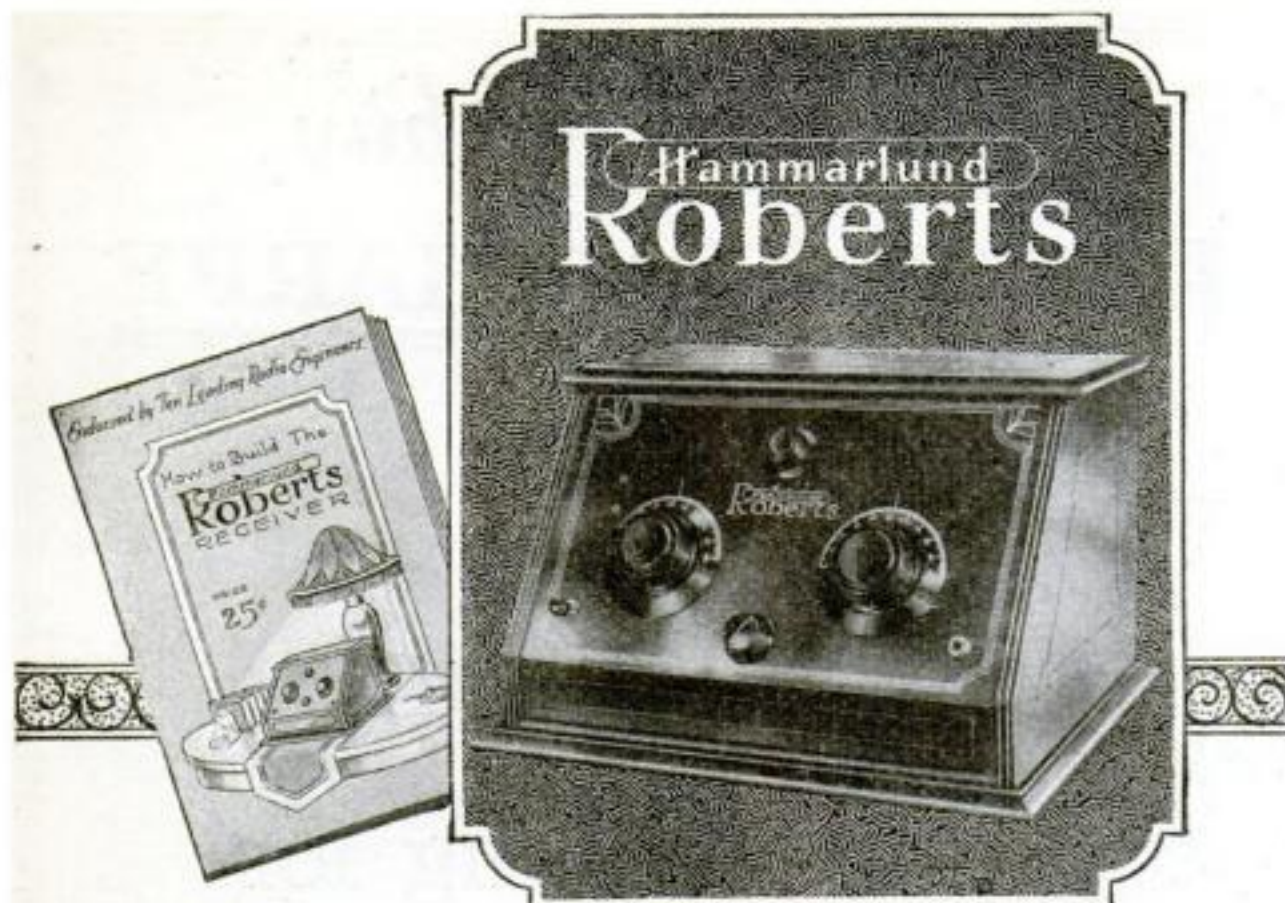


Brown & Sharpe Mfg. Co.
Providence, R. I., U. S. A.

Whether toolmaker, mechanic, machine operator or motor service man, there are tools in the complete Brown & Sharpe line for every need—tools necessary for the best work

If you haven't a copy of our Small Tool Catalog just ask for one at a good tool store - - - or we'll send a copy direct. It will profit you to keep a copy at hand.

"Standard of the Mechanical World"



Write for This "How to Build It" Book

Fully illustrated throughout with complete information on assembling, wiring and operation.

25c

ASSOCIATE MANUFACTURERS

All-American Radio Corp.
Alden Manufacturing Co.
Radial Company
("Amperites")
Carter Radio Co.
Union Radio Corp.
International Resistance
Co., Inc.
("Durham Resistors")
Westinghouse Micarta
Hammarlund Mfg. Com-
pany, Inc.



This famous instru-
ment and other parts
shown are some of the
famous units used in the
Hammarlund-Roberts.

Every Part Designed by a Specialist

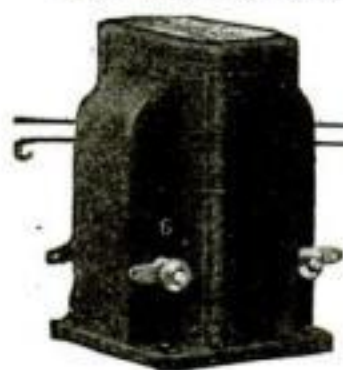
EVERY single unit that goes to make up this remarkable receiver was chosen by a specialist after months of research. The transformers were selected by an engineer familiar with every reliable make; the condensers by a man who had made a special study of condenser constructions and functions. So it was even with the smallest, usually neglected units.

From the work of these engineer-designers, backed by the endorsements of ten famous radio parts manufacturers, comes the Hammarlund-Roberts, a receiver that is truly the ultimate in five-tube possibilities. The equal of a standard eight-tube set, in selectivity and volume—so simple in design and operation that anyone might construct it. Priced amazingly low, the Hammarlund-Roberts offers the greatest value possible in the radio field today.

Complete Parts, less Cabinet, \$60.80

Hammarlund Roberts

HAMMARLUND-ROBERTS, 1182-F Broadway, New York City



Dials and Sockets



AMPERITE



Carter

Switches and Rheostats

Radio Dealers WANTED!

If you are the type of dealer who hustles after business, who isn't content to wait for trade to come in but who takes sets out to demonstrate, can talk and sell quality merchandise, and knows Radio values, we have a big proposition for you. Are you that dealer?

50% Discount to Dealers

We manufacture a complete line of high grade receivers and sell to dealers at 50 per cent discount. We are distributors for more than 225 Nationally advertised lines.

Write today for amazing offers, new 112-page catalog and regular monthly catalogs quoting below-the-market prices on latest merchandise—all free. Everything in Radio for less.

American Radio Mfg. Co.
1416-18 McGee Street, Dept. B, Kansas City, Mo.

SEND NO MONEY 2 Genuine Diamonds 4 / 100 Each

Cut Stones, No Chips
Solid Gold

\$25

Terms if desired
(6 mos. to Pay)

Outside U. S. cash with order

14 kt. White Gold Top. Gold
Emblem (any Lodge) or any
Initial (Old English). Yellow
or White Gold, Inlaid in
Genuine

HOPE RUBY

Also, in Black Onyx

Send size of finger and ring
will be sent for inspection.



New 6132

Send for Free Catalog **D J C M S W** Any
Letter

Buffalo Jewelry Mfg. Co., "The Mail Order House"
Dept. A 501 Washington St. Buffalo, N. Y.

The Home Workshop

Neat House Number Sign Is Visible at Night

YOU are groping your way along a dark street, trying to locate the home of a friend who recently moved. You have no idea how the numbers run, but suddenly you see a lighted window against which appears a neat sign. This is cut out so that the light shines through in the form of figures—the very number for which you are looking.

Seeing the advantage of such a house number, you may wish to make one for your own home. Packing box lumber will do very well. A good size for the main piece is $\frac{3}{8}$ by 5 by 20 $\frac{1}{2}$ in. Lay this on a piece of wrapping paper and mark around it. Cut the paper on the line and fold the piece in two, so that you can lay out an ornamental curve for the ends. By cutting with the scissors, both ends will be symmetrical. Also lay out the figures on the paper, choosing a style that can be cut out easily, such as one having the circular terminals, which can be made by boring. Cut out the ends and figures with a coping or scroll saw.



The number sign is hung before a window.

A piece $\frac{3}{4}$ by 1 $\frac{1}{2}$ by 24 in. is cut in half to form the two supports. These are recessed $\frac{3}{8}$ in. deep where the number piece crosses them so that the sign can be nailed together with the outer surfaces of all parts flush.

Give the whole a coat of light paint and hang by means of screweyes and chain in front of a window, side light, or glazed front door. Many original and attractive variations from the design illustrated are possible.—W. W. WHITE.

Realistic Toy Fire Truck Made from Scraps



WHEELS from an old carpet sweeper, steering gears from a discarded sewing machine, and scraps were utilized in making the toy fire truck illustrated. It is 26 in. long, 8 in. wide, and 8 in. high. It weighs 20 lbs. and will support a weight up to 300 lbs. The metal-working tools used were a post drill, files, and a hacksaw.—WARREN D. PARIS.

The Home Workshop

Graceful Turned Stand for a Jardinière

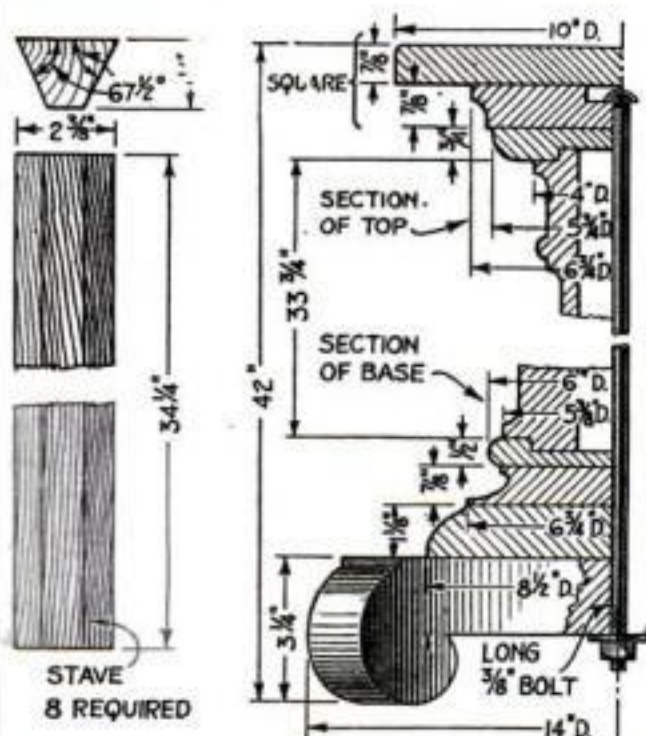
By William J. Edmonds, Jr.



An ornamental plant stand, the round pedestal of which is built up of eight staves

CONTRARY to the first impression conveyed by the accompanying photograph, the construction of this plant stand is not beyond the ability of the average amateur woodworker who has access to a lathe.

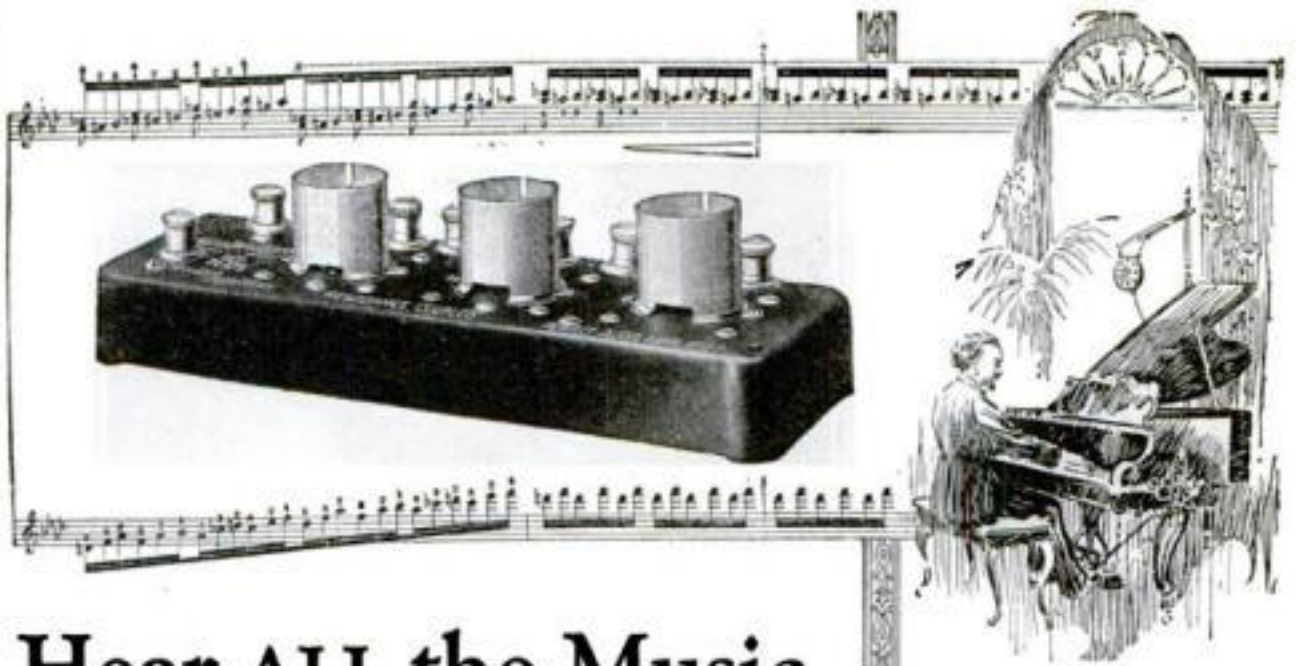
The column is built up of eight segments, as shown in the drawing. These are made slightly longer than the dimensions given and are glued up edge to edge to form an octagon. After the glue has hardened, this column is made circular



One of the staves and a section showing the construction and profile of the pedestal

in shape with drawknife and plane. Two octagonal plugs are fitted into each end so that the pedestal may be placed in a lathe and turned to the shape indicated.

(Continued on page 90)



Hear ALL the Music with the Bradley-Amplifier

THE delicate variations and shadings of instrumental music and the exquisite strains of the vocalist, are amplified with faithfulness and clarity by the Bradley-Amplifier. It matters not whether you own a factory-built set or a home-built receiver, either will be improved by using the Bradley-Amplifier.

Bradleyunit resistors, that are impervious to moisture and unaffected by atmospheric changes, take the place of the audio-frequency transformers of ordinary amplifiers. There is no distortion and no loss of low or high frequencies. All tones are reproduced with equal facility. As a result, the low notes of the piano are greatly improved and the high notes are not choked or distorted into a metallic sound. With a good loud speaker, the Bradley-Amplifier produces a marked improvement in tone quality.

Ask your dealer for the Bradley-Amplifier today, and substitute it for your present audio-frequency amplifying transformers. Resistance coupled amplifiers are acknowledged by radio experts to be the most perfect type of amplifier. You can make your set perfect with a Bradley-Amplifier.

Retail Prices:

In U. S. A., \$15.00 • In Canada, \$21.00

Allen-Bradley Co.
Electric Controlling Apparatus

Milwaukee



Wisconsin



Mfrs. of
Electrical Devices
for Over
Twenty Years



Can be installed within radio cabinet. UX tubes as well as old tubes can be used.



All resistors, condensers and wiring, are concealed within the compact Bakelite base.



Bradleyunit resistor is made of solid molded material which does not change with age. All units soldered.



Mail
the Coupon



ULTRA-LOWLOSS CONDENSER

CAP. 0005 mfd.

\$5.00

Quick, positive tuning

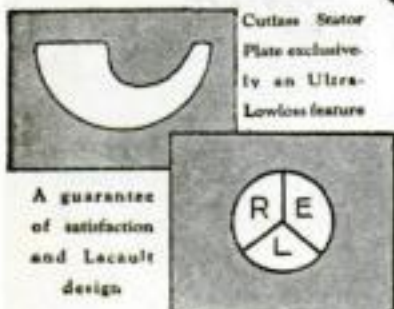
Speed—ability to turn directly to any station, to tune-in instantly and get your station without interference from broadcasting on similar wavelengths—is the outstanding feature of the Ultra-Lowloss Condenser.

With one station of known wavelength located on the dial, all others can be found instantly. Special design of Cutlass stator plates distributes stations evenly over the dial—each degree on a 100 degree dial represents approximately $3\frac{1}{2}$ meters difference in wavelength.

In addition, losses common in other condensers are reduced in the Ultra-Lowloss to a minimum by use of only one small strip of insulation, by the small amount of high resistance metal in the field and frame, and by a special monoblock mounting of fixed and movable plates. Designed by R. E. Lacault, E.F., originator of the famous Ultradyne receiver and Ultra-Vernier tuning controls.

At your dealer's; otherwise send purchase price and you will be supplied postpaid.

ULTRA-LOWLOSS CONDENSER



ULTRA-VERNIER
TUNING CONTROL

Simplifies radio tuning. Pencil record a station on the dial—thereafter, simply turn the finder to your pencil mark and you get that station instantly. Easy—quick to mount. Eliminates fumbling, guessing. A single vernier control, gear ratio 20 to 1. Furnished clockwise or anti-clockwise in gold or silver finish.

Silver, \$2.50
Gold, \$3.50

PHENIX RADIO CORP., 114-A E. 25th Street, NEW YORK

Amaze Your Friends With Chemical Tricks

Write secret letters with invisible ink; pour blue, brown and black liquid from a glass of water; make a magic pitcher of bluing; make your own magic writing paper, your own ink and dyes. It's all easy if you have Chemcraft Junior—the pocket Chemical outfit. Get yours now. Order right away and get a FREE Copy of The Boy's Handbook of Chemistry; 100 pages of experiments, formulae, interesting chemical information, money-making suggestions and catalog of supplies.

BOTH 25¢ POSTPAID

THE PORTER CHEMICAL CO.
115 Washington St.
Hagerstown, Md.

The Boy's Handbook of Chemistry
Price 15 Cents

CHEMCRRAFT JUNIOR
CHEMICAL OUTFIT
PRICE 25 CENTS

Help Wanted

We require the services of an ambitious person to do some special advertising work right in your own locality. The work is pleasant and dignified. Pay is exceptionally large. No previous experience is required, as all that is necessary is a willingness on your part to carry out our instructions. If you are at present employed, we can use your spare time in a way that will not interfere with your present employment—yet pay you well for your time.

If you are making less than \$150 a month, the offer I am going to make will appeal to you. Your spare time will pay you well—your full time will bring you in a handsome income.

It costs nothing to investigate. Write me today and I will send you full particulars by return mail and place before you the facts so that you can decide for yourself.

ALBERT MILLS, Gen. Mgr. Employment Dept
4926 American Bldg., CINCINNATI, OHIO.

The Home Workshop

Kitchen Ceiling Vent Carries Off Fumes of Cooking

A VENT above the gas range for drawing off steam, smoke, and cooking odors has come to be a real necessity in the modern home. An improved "smoke catcher" for a bungalow or any house where the space above the stove corner of the kitchen is not otherwise utilized, may be constructed as shown below.

The ceiling joists above the kitchen chimney flue are cut away to make a square opening about 4 by 4 ft. The loose ends are braced with a header. A vent box 8 by 8 in. is placed 8 in. higher than the top of the ceiling joists. Con-

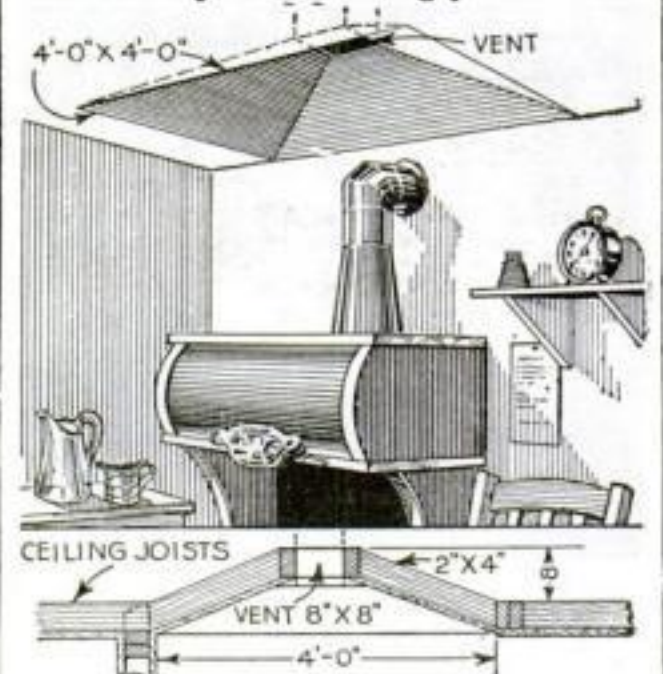


Diagram showing the general arrangement of the ceiling vent and a cross section

necting braces of "two by fours" are run from each corner of the vent box to the plate. These support the vent and carry the lathing. Additional braces may be used if desired. The recessed portion then is lathed and plastered or finished with wallboard like the ceiling.

Nail screen wire over the vent box from above and connect it, at any desired angle, with a galvanized iron roof vent by means of another box of rough lumber 8 by 8 in.

As the ceiling vent is placed at the highest point above the stove, the greasy smoke and fumes pass upward through the screen and then through the box to the roof.—A. MAY HOLADAY.

Graceful Turned Plant Stand

(Continued from page 89)

Note that there is a tenon on each end.

Instead of turning the column with straight sides, it has a slight swell from the base to about two-fifths the height, where it begins to curve in toward the top. This gentle curve is to overcome the optical illusion of slight concavity that a straight-line profile would have.

The remainder of the construction requires no explanation, excepting that a long $\frac{3}{8}$ -in. bolt or a rod threaded at both ends passes through the center of the different pieces and when tightened keeps all in place.

The pedestal may be finished as the taste of the builder dictates, preferably with varnish or wax.

The Home Workshop

New Handkerchief Vanishing Trick

By Kenneth B. Murray



How the handkerchief is stamped into the cone, and the "vanish" as the performer sees it

OF THE many methods for vanishing a handkerchief, the one pictured above is perhaps the easiest for the amateur to master and, at the same time, it is one of the most spectacular.

A small silk handkerchief, preferably bright red, is placed in an unprepared paper cone. The magician stamps the handkerchief into the cone with his magic wand and, as he withdraws the wand, shows that the handkerchief has disappeared.

The secret lies in the construction of the wand, which is hollow. In the wand is a

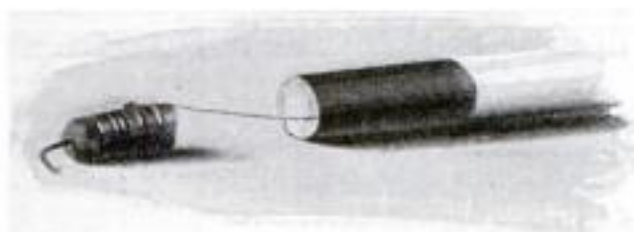
(Continued on page 92)



The paper wand is rolled about a pencil



Coloring the tube with waterproof paint



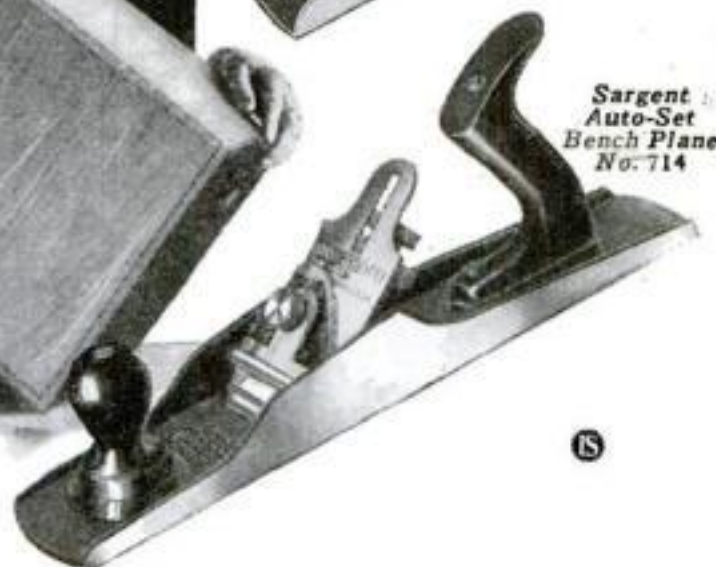
The hook and thread drawn out from the wand

SARGENT

PLANES



Sargent Steel Block Plane No. 5206



Sargent Auto-Set Bench Plane No. 714

Be sure the planes you buy come up to Sargent standards

YOU may never have to put your plane to the tests that most carpenters give theirs. Nevertheless you want your work to have the finish that only the best of planes can give. The same qualities that make Sargent Planes the choice of carpenters should govern your selection.

Sargent Construction: Wear-resisting materials are used throughout. Chromium steel is used for the cutters—an unusually tough metal that takes a keen edge and holds it.

Sargent Performance: Absolute rigidity of cutter, even across and

against the grain or over knotty surfaces. Adjustments quickly and easily made. In the Sargent Auto-Set (the larger plane illustrated) the cutter can be removed, sharpened and replaced without changing original adjustment.

Sargent Economy: Sargent Planes are moderate in cost and prove a real economy by improving work and saving time. Seldom if ever do they need repair or replacement.

The two Sargent Planes shown here should be in every home and school workshop. See them at your dealer's. Write for booklet.

SARGENT & COMPANY, Manufacturers
50 Water Street New Haven, Conn.

Make More Money

Read the Money Making Opportunities on pages 120 to 150 of this issue.

DIRECT AT FACTORY PRICES—This \$2 Knife \$1.18 Postpaid

Hand Forged Razor Steel Blades, No. 57



Send for our 100-page List and "HOW TO USE A RAZOR" FREE

MAHER & GROSH CO., 110 A St., Toledo, Ohio

The
handiest
tool on the
place



Saves
-money
-muscle
-minutes

SIMONDS HOME AND FARM SAW

Repairs to be made—odd jobs to be done—that is the call of Spring. So Spring calls for Simonds Home and Farm Saw with teeth that bite their way smoothly and easily through the toughest board. In the Home and Farm Saw, Simonds has produced a cutting tool worthy of the name. Confining manufacture to one size—24 inches long—Simonds is able to offer the Home and Farm Saw at \$2.00—a price that is actually less than you *thought* you would have to pay for an *ordinary* saw. Ask your hardware dealer about this saw today.

SIMONDS SAW & STEEL COMPANY
Fitchburg, Mass.
"The Saw Makers" Established 1832
Branch Stores and Service Shops in Principal Cities

SIMONDS
Pronounced SI-MONDS
SAWS FILES KNIVES STEEL

The Home Workshop

Riding an Ice Chair Is Novel
Sport for Skating Parties



WHEN the ice is thick enough for skating, you can have a lot of sport by equipping a common folding camp stool with runners to form a skater's chair. The runners, which are strap iron or even wood, are bolted to the legs of the chair.

The occupant of the chair sits with his or her skates directly in front and must grip the chair firmly so as to present a stiff back to the one who is pushing from behind. When not in use on the pond, the chair can be used near the edge by those who wish to rest or remove their skates.—G. EVERETT VAN HORN.

Handkerchief Vanishing Trick

(Continued from page 91)

small hook tied to a $\frac{1}{2}$ -in. length of pencil. To this hook is fastened a strong black silk thread, which runs through the wand and is tied to a black button on the magician's vest.

The hook lies near the end of the wand that is used to stamp the handkerchief in the cone. During the stamping process the handkerchief is caught by the hook and then it is drawn into the wand by a movement that carries the wand away from the body. This movement, while appearing perfectly natural to the audience, causes the thread to pull the hook from one to the other end of the wand and draws the handkerchief out of sight. The black thread cannot be seen at a distance by the audience. The clothes of the performer, of course, should be dark in color.

After the "vanish," place the wand with its contents in the inside coat pocket, at the same time attracting the attention of the spectators to the paper cone, which they should be asked to examine. If they wish to see the wand, hold the handkerchief and hook by the thread and draw out the empty wand.

The wand is prepared by rolling a sheet of heavy typewriter paper around a pencil, gluing the edge, and coloring the tips with waterproof black paint. The short piece of pencil with the handkerchief hook should fit tightly.

Get the New MATCHED AERO COILS

T. R. F. Kit
Matched Coils
\$12.00



For SELECTIVITY and DISTANCE

Regardless of how good your set seems to be, you can make it many times more selective and much more powerful by replacing your T. R. F. transformers with Aero Coils. Get Aero Coils now—and tune through strong locals and bring in DX with tremendous loud speaker volume!

95% AIR DIELECTRIC

The secret of Aero Coils' markedly superior performance is its patented construction which makes possible the correct use of 95% air dielectric and dopeless, air-spaced windings with the consequent advantages of lower high frequency resistance and distributed capacity.

AT YOUR DEALERS OR DIRECT

T. R. F. Regenerative Kit...\$11.00
3 Circuit Tuner..... 8.00
Wave Trap Coil..... 4.00
Oscillator..... 5.50

Write for the Aero Booklet

AERO PRODUCTS, Inc.
217 N. Desplaines Street, CHICAGO

Only \$5 Down

Buys Any WITTE
Latest Model



All-Fuel Engine $\frac{1}{2}$ to 10 H.P.

The One-Profit Engine. Sold Direct From Factory To You. Easy Terms on best engine built. Burns Kerosene, Distillate, Gas-Oil, Gasoline or Gas. Change power at will. Equipped with the famous WICO Magneto, speed and power regulator and throttling governor. 2 to 25 horsepower—ALL STYLES.

FREE Write today for my Big Engine Book. Sent free—no obligation on your part. Or, if interested, ask for our Log and Tree Saw, 3-in-1 Saw Rig or Pump Catalogs.

WITTE ENGINE WORKS

2227 Witte Building, KANSAS CITY, MO.
2227 Empire Building, PITTSBURGH, PA.



Collapsible LOOP AERIALS

Popular Prices—Remarkable Results

No better loops at any price. Quantity production keeps prices low. Handsome, convenient and efficient.

LINCOLN 4-POINT TAPPED LOOP . . . \$8.00

Built for any circuit where it is desired to vary the inductance of the loop. Exceptionally fine for Superhets.

LINCOLN CENTER-TAPPED LOOP . . . \$6.50

For any set employing radio frequency amplification.

For certain Superhets requiring a center tap. If your dealer cannot supply you, order direct, giving your dealer's name. Write for illustrated catalog PS

LINCOLN RADIO CORPORATION, 224 N. Wells St., Chicago

WADE BENCH LATHE



Cap 4" dia. x 12" length. Slidest has travel entire length of bed. Lead-screw inside bed. Hollow spindle. Turning, facing, boring, drilling, winding, thread-cutting.

No. 1 Lathe, plain headstock \$28.00

No. 2 Lathe, back-gear headstock \$38.00

Complete line of accessories at equally low prices. New Catalog sent free.

THE GEORGE COMPANY

Dept. P. S. 7, 120 Liberty Street, New York

HB ONE DAY BATTERY CHARGING



The lowest-priced complete One Day Battery Charger on the market. Brings big profits charging auto and radio batteries. Only \$35 cash brings complete HB equipment. Easy monthly payments. 30 days' trial on moneyback guarantee. Write for free bulletin.

HOBART BROS. CO., Box P 126, Troy, Ohio.

NOW ONLY \$35 THIS MONEY MAKING SERVICE IN YOUR SHOP

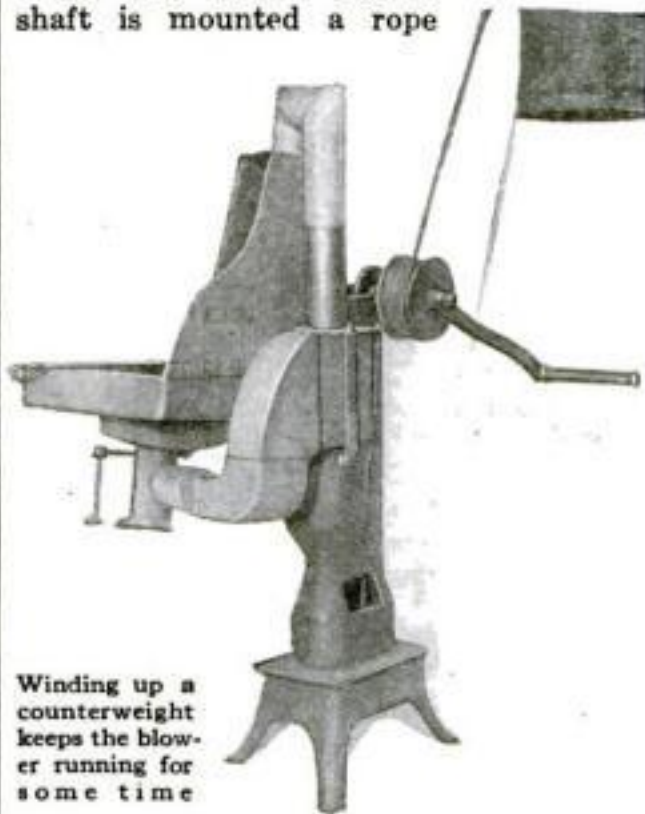
The Home Workshop

Discarded Cream Separator Converted into Forge

IN THE junk pile there is often some discarded machine that can be converted into a forge. In this case an old cream separator was used.

A fan was made and mounted in place of the bowl, with a bicycle hub for ball bearings. The axle was connected with the high speed shaft and, as there is a friction clutch in the machine, the handle can be worked as a lever without turning it all the way around.

On the crank handle shaft is mounted a rope



Winding up a counterweight keeps the blower running for some time

drum. The rope, which is carried from the drum over a sheave mounted high up, is tied to a large pail filled with concrete. The crank can be turned backward to wind the weight up and the weight then keeps the forge running for a time while ironwork is being hammered out.

The speed of the fan can be regulated by the weight. The upper air intake on the fan case helps carry away the smoke.

The tuyere iron for the fire pan is made from a 2-in. well pipe driving cap, crown side up, with a bolt set in it as a shaking handle. Four $\frac{1}{2}$ -in. holes were drilled in it to admit the air.—A. C. BRUNDAGE.

Canvas-Covered Frames Form a Decorative Screen

AFTER re-finishing a breakfast room suite, I hunted unsuccessfully through the stores to find a folding screen that would harmonize with the furniture and at length built a screen of my own design.

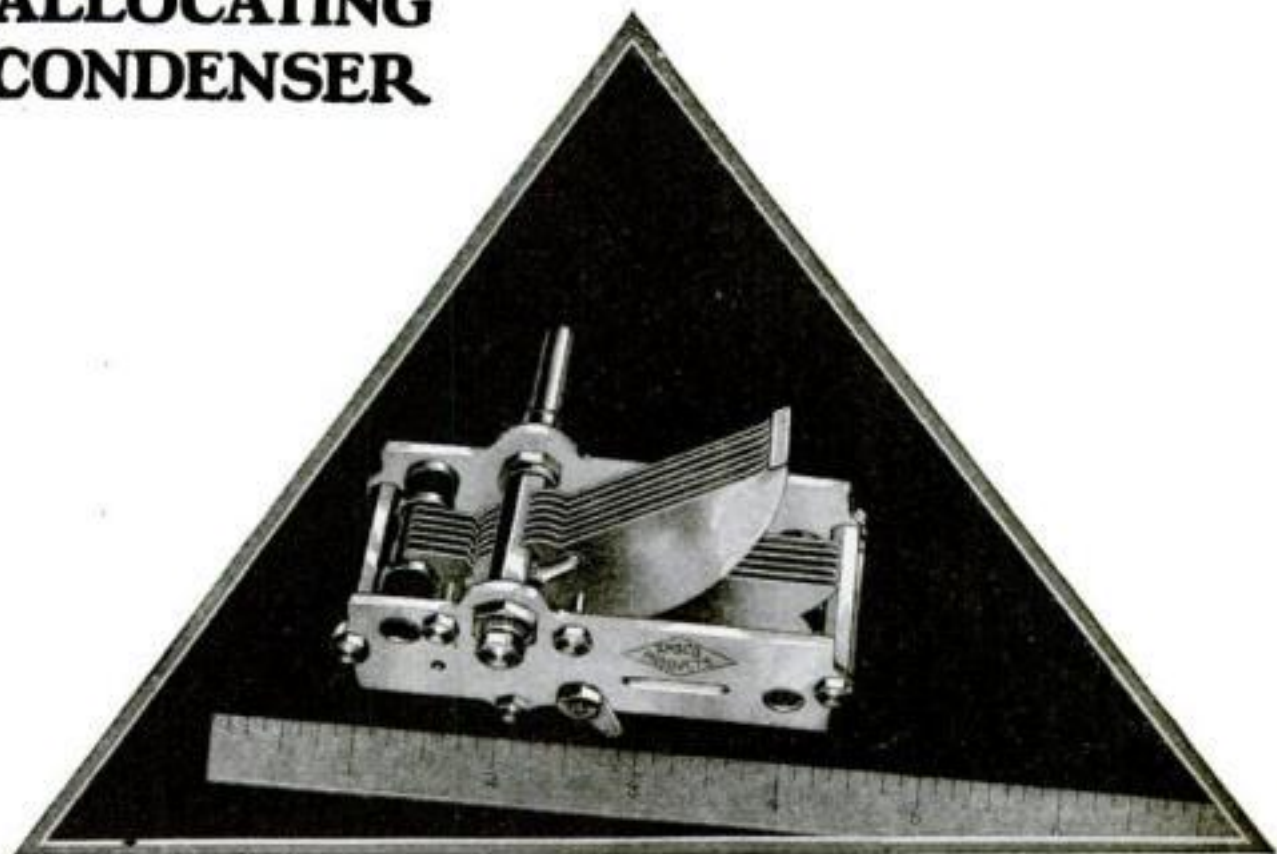


The screen is painted to match other pieces

The frames are made of 1 by 2 in. finished white pine, butt jointed, with steel angle clips inside each corner. These are covered with light canvas—muslin will do—sewn like a bag on a sewing ma-

(Continued on page 94)

The AMSCO ALLOCATING CONDENSER



IT SAVES SPACE!

This straight line frequency condenser is a space-saver in the radio cabinet . . . It can usually be substituted for the old time condensers in existing sets . . . Once installed, it revolutionizes your ideas about tuning . . . Those Amsco half-a-heart-shaped plates add Kilocycles at the rate of ten to each dial division—giving "a station for every degree" . . . All wavelengths—high or low on the scale—tune in with equal ease . . . Amsco allocation of the stations is uniform and correct to within a fraction of 1% . . . Insist on Amsco Allocating Condensers . . . Made in six space-saving models, three Single and three Siamese, at very reasonable prices.

Amsco Products, Inc.,
Dept. G

Broome & Lafayette Sts.
New York, N. Y.



OTHER AMSCO PARTS

Write for our booklet, "The Heart of the Hook-up" for full details and prices of the entire Amsco line. Amsco for Excellence.

Get this FREE Record!

DOUBLE-DISC phonograph record of two beautiful Musical Saw solos sent without charge. Hear the marvelous possibilities of this sensational instrument.

Complete Outfit,
Sent On
Trial

No notes to read. No dreary practice. Just three short, simple lessons and you play popular and classical music. I guarantee success; no charge whatsoever if I fail. Thousands of my students are amazing friends, playing in dance and broadcasting orchestras or at lodge and church entertainments. Write for SPECIAL INTRODUCTORY OFFER of Saw, Hammer, Bow and Rests, FREE with Course of Instruction and how you can obtain complete outfit on trial.

MUSSEHL & WESTPHAL
263 West Water St. Fort Atkinson, Wis.

PLAY A SAW

ADDING MACHINE VEST POCKET SIZE

ADDS—SUBTRACTS—MULTIPLIES—DIVIDES
Does work of \$300 machine. Guaranteed 5 years.
NOT A TOY.

Made of steel and indestructible. Million dollar capacity. Fits in pocket. Will not make mistakes. So simple child can operate it. Every body should carry one for figuring.

BABY CALCULATOR
CHICAGO U.S.A.
PATENT APPLIED FOR

\$2.50

FREE TRIAL

Send No Money—Just name and address. We will ship Calculator immediately prepaid. On delivery pay postman \$2.50. If not satisfied after 10 day trial get your money back. THOUSANDS OF SATISFIED USERS.

This is the lowest priced practical Calculator made. "Why pay more for inferior imitations?" Order from this ad.

BABY CALCULATOR SALES CO.,
P. O. Box 1118, Chicago, Ill., Dept. 21
Write for big commission and territory proposition.

AGENTS



PEXTO SNIPS
Famous since 1819

YOU will find it a pleasure to work with Pexto Tools. They are made from highest grade materials, parts that require strength are drop forged, cutting edges are of best tool steel properly heat treated, parts that are liable to wear are hardened, in fact, all branches of our manufacturing and selection of materials are carried on scientifically and each and every tool is carefully inspected before being packed for shipment.

The line consists of Bit Braces, Auger Bits, Squares, Chisels, Hammers, Hatchets, Pliers, Monkey and Pipe Wrenches, Angle Wrenches, Screw Drivers, Snips, Compasses, Pruning Shears, Dividers, Calipers, Pincers, Soldering Coppers and many other small tools.

The Peck, Stow & Wilcox Co.
Southington, Conn., U. S. A.

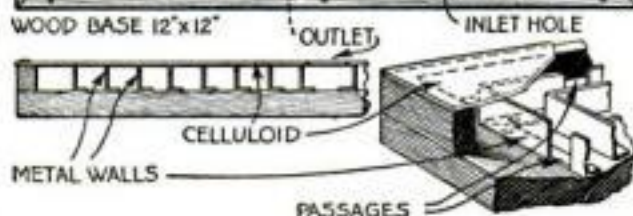
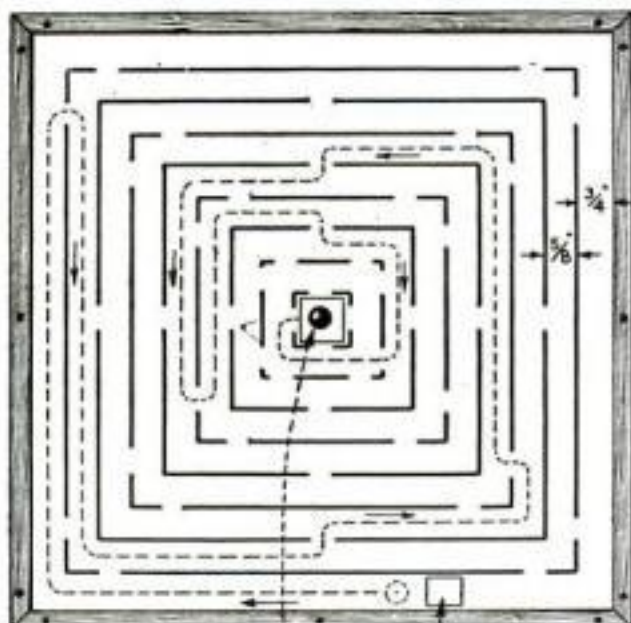
PEXTO

Worth While
TOOLS

The Home Workshop

Complicated Labyrinth Puzzle Can Be Constructed Easily

LABYRINTH puzzles exert a perpetual fascination, especially when they depart from the conventional and familiar designs. In the puzzle illustrated, a marble is inserted through a hole in the celluloid cover and rolled around the corridors until it reaches the center, when it can be removed. The problem is apparently an easy one to solve as there



Only one opening in each division is large enough to allow the marble to pass

are numerous openings, but the marble will pass through only certain ones.

The base is wood, $\frac{1}{2}$ by 12 by 12 in. It is bordered with strips $\frac{1}{2}$ by $\frac{3}{8}$ in., to which the celluloid is to be fastened. The divisions are made of thin metal as shown, and are tacked in place. While each has four or more openings, only one gap is wide enough to allow the marble to pass. The others are a trifle too narrow, the difference of a hair's breadth being sufficient. It should be so slight that it cannot be noticed by the player.

When the openings have been tested, the cover is cemented and screwed or tacked in place.—DONALD W. CLARK.

A Decorative Screen

(Continued from page 93)

chine. Each of the covers must be of a size to slip over the frame tightly. The open end then is lapped under neatly and tacked in place.

The canvas is coated with size composed of 1 lb. of glue and 8 qts. of water. As many coats are applied as are necessary to pull the fabric taut.

The entire surface of the panels then is given two coats of light gray waterproof enamel. The edges are bound with $\frac{1}{2}$ -in. gimp fastened with upholstery nails. Designs are stenciled on one side with oil-tube colors to match the other furniture.

The panels are fastened together with double-jointed brass screen hinges, which allow the screen to be folded in either direction.—J. F. HARDECKER.

BARGAINS In Rebuilt MOTORS



\$8.00

each
F. O. B.
Chicago
1/6 and
1/4 H. P.
A. C. &
D. C.
110 Volt

These motors have been taken in trade and thoroughly rebuilt in our own shops.

Many Standard Makes

Robbins and Meyers, Emerson, Marathon, General Electric, Westinghouse and other makes.

These motors are ideal for lathes, blowers, small drills, household washing machines, cream separators, ventilating fans, etc.

Every motor guaranteed to give perfect satisfaction or money refunded (less return charges). Send cash with order.

Complete line of new motors. Prices on all types on request.

NORTHWESTERN ELECTRIC CO.

410-420 S. Hoyne Ave., Dept. 2, Chicago, Illinois

CARTER New "Flat" Plug [Pat. Pend.]



New original Carter design. Fits flush against panel. Cord hangs down. Cord tips quickly and easily attached or detached. No push buttons, trick triggers or springs. Positive, simple. Improves appearance of any set.

Any dealer can supply.

In Canada—Carter Radio Co., Limited, Toronto

Carter Radio Co.
300 S. MICHIGAN AVENUE
CHICAGO, ILL., U.S.A.

WANTED



Men to manufacture Metal Toys and Novelties. Good chance to start your own well-paying business producing such



big sellers as Toys, Novelties, Ash Trays, Book-blocks, Souvenirs, Advertising Specialties, Paper Weights, etc. We furnish forms with complete outfit for speedy production. Absolutely no experience of tools necessary; no special place needed. Small investment puts you on road to success. Demand exceeds supply and we assist and co-operate with our manufacturers in selling their products. We put you in touch with the buyers and assure an outlet for your goods. Strictly a business proposition and thorough investigation invited. A splendid opportunity for an enormous and profitable business for ambitious men. No others need apply. Catalog and information mailed on request.

METAL CAST PRODUCTS CO.
1696 Boston Road New York

The Home Workshop

Gumption with Tools

(Continued from page 71)

auger, and a saw, and he could make a river raft, a corduroy road, post-and-rail fence, a barn, a hen coop, a pig sty, a dog house, a church, a fort, or a village, and these structures would be more substantial than similar structures of today.

But, to these three tools the men of yesterday added that great quality that is produced by the frontier and has enabled us to bore through mountains, to bridge over chasms, to go under and over rivers, to build the Panama Canal, to manufacture and operate steam engines, automobiles, flying machines, steam craft, sailing craft. Without it every invention of today and all the tools in the world are so much rubbish. That quality, that attribute of the mind, is GUMPTION.

IT'S gumption that made the Yankee notions famous; it's gumption that is absolutely necessary for a plainsman, a mountain man, a pioneer, a backwoodsman. He must possess it or die.

It is the absence of gumption that makes what we call a "chump" or a "boob," a "duffer," a "doodle," a "dizzard," a "noddie," "dunderaddle," or a "mollycoddle," according to the part of the country in which we live.

The Huck Finns, the Tom Sawyers of the river bottoms, the street gamins of the city, all have gumption. The old-time workmen possessed a phenomenal amount of gumption, but it seems to be sadly lacking today.

While sitting around the blazing logs of a camp fire in the mountains one winter night in company with Frederick K. Vreeland, electrical and consulting engineer, Col. David Abercrombie, the famous outfitter, Edmund Seymour, the banker and former ranchman, and other boon companions, some one noticed a lump, wart, or bunion, so to speak, on a white oak cordwood stick, which was about to be put in the fire. Such protuberances are known as "burls."

THIS burl was removed from the stick of wood by means of the camp axe. After that it was passed from hand to hand and modeled until it took the form of a drinking cup, or "noggin."

Dry oak wood is exceedingly hard and difficult to cut. These men, therefore, soon tired of using their hunting knives and searched for some better sort of a tool with which to dig out the inside of the burl. There were no tools where we were camped, but one of the party found a rusty blade of a file near the site of an old barn. The end of the file was thrust into the hot coals and kept there until the metal was red hot; it was then hammered and its end made into the form of a hook. After this it was retempered by dipping the hot iron into water; then the edges were sharpened on a stone.

With this hand-made tool these wilderness men gouged out the inside of the burl so neatly that in some places one may see the light when it is held up to the sun.

(Continued on page 96)



An overnight charge with a Tungar costs about a nickel. It peeps up both "A" and "B" batteries and keeps your radio set at its full-toned best.

Tungar—the original bulb charger—is noiseless. It contains no substance which could spoil furnishings. Just clip it to your set and plug it into the house current. It can't blow out Radiotrons if the battery is left hooked to the set while charging.

Use a Tungar—the charger that needs no attention.



The Tungar is a G-E product, developed in the Research Laboratories of General Electric.

The new Tungar charges any make and size of storage battery: radio "A" and auto batteries, and "B" batteries as high as 96 volts in series.

East of Rockies

Two ampere size \$18.00
Five ampere size \$28.00

60 cycles . . 110 volts

Tungar
REG. U.S. PAT. OFF.
BATTERY CHARGER

Tungar—a registered trademark—is found only on the genuine. Look for it on the name plate.

Merchandise Division
General Electric Company, Bridgeport, Conn.

GENERAL ELECTRIC

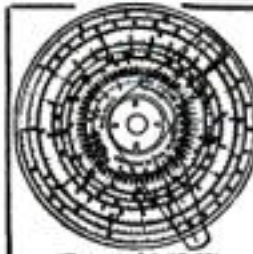


Tool Cases

for Machinists, Carpenters and Tool Makers; none better; thirty styles. Quartered oak and metal covered. Ask for booklet.

"Built for Service"

The Pilled Lumber Co., Swanton, Ohio



The Midget "Five-in-One" Slide Rule is a combination Mannheim, Polymetric, Log-Log, Binary, Add and Subtract Slide Rule. It will instantly add, subtract, multiply and divide any combination of whole numbers, fractions, mixed numbers and decimals. Gives every root and power, also Logs, Sines and Tangents. Made of aluminum with scales on white celluloid. Size 4 in. Approved and adopted by colleges. Price with instructions, \$1.50. Leather Case 50c extra. Sent C.O.D. if desired. Catalogue Free. GILSON SLIDE RULE CO., Niles, Mich.

JUST OUT! GREEN, RED. SELLS FOR \$1.25. SAMPLE 67c



Unbreakable, TRIO Self-Filling Fountain Pens. Ideal Xmas Gift. Comes in Holly Box. Guaranteed for 2 Years. "It makes carbon Copies." Money refunded if you do not think it is the best pen you ever wrote with. Finished in beautiful green, red, purple or black. Send for wholesale quantity price list and distributing plans.

F. SPORS & CO.,

198 4th Street,

Lesueur Center, Minn.

TRIMO

Has 4 Points
Of Superiority



1. The TRIMO PIPE WRENCH has an insert jaw in the handle which can be replaced for a few cents when years of service wear it out. Here is an economic feature not found in any other make of wrench.

2. NUT GUARDS on the TRIMO keep this rugged tool in perfect adjustment, a great convenience especially when working in close quarters.

3. TRIMO has a Steel Frame that WILL NOT BREAK, insuring great strength and your personal safety.

4. TRIMO is expertly designed which makes for better balance, better work, longer life. These are all FACTS—not mere claims, but tangible things that you can see with your own eyes by inspecting the TRIMO at any mill, oil, plumbing-supply or hardware store.

In eight STEEL handle sizes from 6 to 48 inches; in four WOOD handle sizes 6, 8, 10 and 14 inches.

TRIMONT MFG. CO.
ROXBURY, MASS.

America's Leading Wrench Makers
for Nearly Forty Years.

The Home Workshop

Gumption with Tools

(Continued from page 95)

The noggin or drinking cup above described hangs by a thong from my belt on all my hunting and fishing excursions. It is beautifully polished and it has traveled with me from Florida almost to Hudson Bay, and from the Atlantic to the Pacific. It is the most serviceable and convenient personal drinking cup I ever possessed and the only tools used in making it were an axe, a hunting knife, and an old rusty file, but with these tools was mixed that wonderful ingredient called *gumption*.

Among the arms hanging on my studio wall are two great knives almost as large as a machete, which my brother picked up on the battle field of Fort Donaldson. These knives were used by the Confederate soldiers and were homemade affairs fashioned from big rasp files.

For *gumption* and ingenuity in making emergency tools, I believe that displayed by Colonel Rose of the Seventy-Seventh Pennsylvania Volunteers was the most notable, when he planned and conducted the digging of the famous Libby Prison tunnel during the Civil War. No tools were used, but spoons, old table knives, and a bit of hoop iron.

IN FRONT of Vicksburg during its siege the U. S. Engineers were ordered by Grant to bridge a bayou. They set to work in a masterful and scientific manner, but— Well, the backwoodsmen of the Thirtieth Missouri Volunteers being idle, asked permission to try their hands at building a bridge. When permission was granted, one man swam across the sluggish current in the bayou and cut down a tree on its banks, at the same time another stalwart backwoodsman was making the chips fly from a tree at his side.

The two trees fell, their spreading branches interlacing in the waters of the bayou. Then all the Thirtieth men got busy dragging branches and brush with which they covered the two trees. On top of this they heaped sods and dirt.

The U. S. Engineers ceased work on their bridge and gladly helped the brawny frontiersmen. In a remarkably short time there was a good road across the bayou underneath which the water slowly flowed through the branches of the fallen trees and over which the troops and artillery passed in safety and comfort.

GENERAL Andy Hickenlooper built a pontoon bridge across the Tennessee River of cotton bales and a few boards from the ruins of a cotton gin.

After taking a course of civil engineering and surveying at Worrals Academy in Kentucky, it was my good fortune to get a position under General Hickenlooper. While eating lunch at Bold Face Creek, in the southwestern division of the topographical survey of what afterward became greater Cincinnati, the General told me about that pontoon bridge.

General Grant ordered a bridge

(Continued on page 97)

BRISTLES OR BADGER HAIR

When you select a Shaving Brush for its "business end" it will of course be a WHITING-ADAMS

VULCAN RUBBER CEMENTED



WHITING-ADAMS Shaving Brushes are made from selected bristles and Badger Hair only. The "business end" of every Whiting-Adams brush is full and bushy, carries a copious lather that works in easily and softens the beard quickly. Naturally the bristles "stay put"—that's expected.

Every hair is permanently imbedded in hard rubber

VULCAN RUBBER CEMENTED

WHITING-ADAMS
BOSTON

Brush Manufacturers for 117 years and the largest in the World

FOR CLEAR, QUIET "B" POWER



RADIO
Storage "B" Battery

12 Cells 24 Volts Lasts Indefinitely—Pays for Itself Economy and performance unheard of before. Recharged at a negligible cost. Delivers unfailing power that is clear, pure and quiet. Approved and listed as Standard by leading Radio Authorities, including Pop. Radio Laboratories, Pop. Sci. Inst. Standards, Radio News Lab., Lefax, Inc., and other important institutions. Equipped with Solid Rubber Case, an insurance against acid and leakage. Extra heavy glass jars. Heavy rugged plates. Order yours today! SEND NO MONEY Just state number of batteries wanted and we will ship day order is received. Extra offer: 4 batteries in series (96 volts), \$10.00. 1 day expressman after examining batteries. 6 per cent discount 1 r cash with order. Mail your order now!

WORLD BATTERY COMPANY
1219 So. Wabash Ave., Dept. 80 Chicago, Ill.
Makers of the Famous World Radio "A" Storage Battery
Prices: 6-volt, 100 Amp. \$11.55; 120 Amp. \$13.55; 140 Amp. \$14.00.
All equipped with Solid Rubber Case.

World
STORAGE BATTERIES
Set your Radio Dials at 230 meters for the new 1000 watt World Storage Battery Station, WSKC, Chicago. Watch for announcements.

Now, Only \$39

Let Me Send You the Greatest LOG SAW Offer

—I ever made. One man saws 15 cords a day—easy. Falls trees, saws limbs. Make big money. Use 4 H-P. Engine for other work. Saws faster than 10 men. Shipped from Factory or nearest of 10 Branch Houses. Cash—Easy Terms. Write for 30-Day Trial Offer and big FREE book.

OTTAWA MANUFACTURING COMPANY
1801-W Wood Street, Ottawa, Kan.
Room 1801-W Magee Bldg., Pittsburgh, Pa.

GEARS
All Kinds—Small

The most accurate made and prices reasonable. We carry a complete line of gears in stock for immediate shipment. Can also quote on special gears of all kinds. Send us your inquiries.

Write for Catalogue 214
CHICAGO STOCK GEAR WORKS
105 South Jefferson Street Chicago

Getting Ahead?

Read the advertisements on Pages 120 to 150 this issue if you want to get ahead!

The Home Workshop

Gumption with Tools

(Continued from page 96)

built. General Hickenlooper asked for a regiment of soldiers; they were given to him. He made a raid upon some contraband cotton concealed in the back country, and built a bridge as described, but he told me that when the artillery went over that bridge his heart was in his mouth. Each cotton bale, as a gun carriage struck it, disappeared under water and popped up again behind the passing caisson. This happened with every gun that passed over the bridge. Nevertheless, the structure held together and the troops and artillery crossed in safety, although they did not make a dry passage.

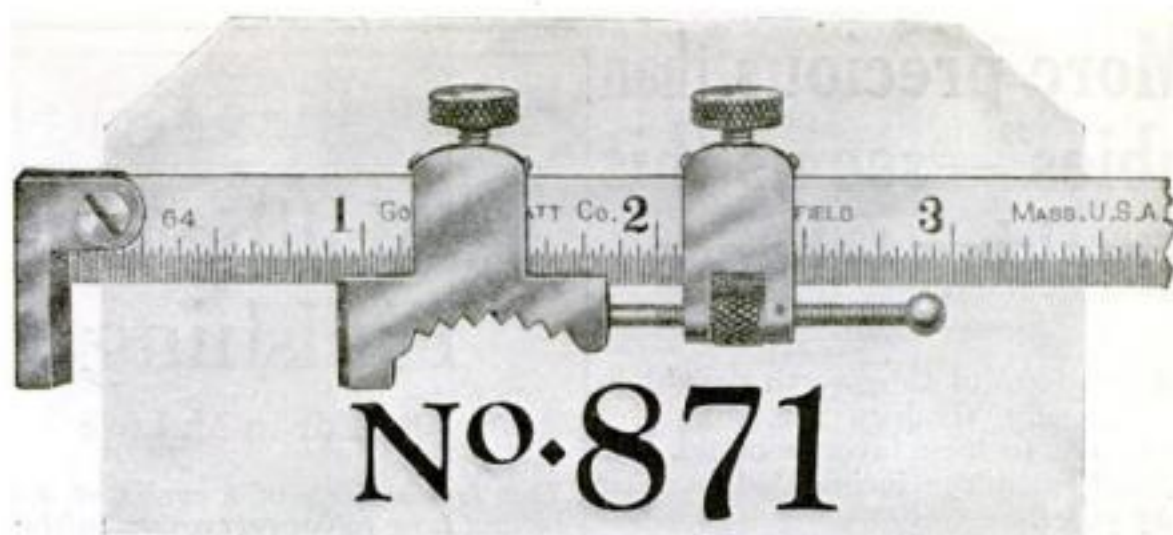
THE Daniel Boones of our early history frequently lost the lockpins and screws that held their flintlocks on their rifles; the locks then were bound on with green rawhide. When this dried, the parts were held together tighter and safer than any screw or pins could make them; also they were repaired easily. I have one such rifle now beside me.

I also have at hand an air gun made by a janitor. The barrel is a brass tube from some piece of machinery. It is a wonderful invention. Without reloading, it will shoot 50 or 60 times with great force and precision. The pump to it is worked so easily that a little child can operate the gun without undue expenditure of effort. Every part of the gun is made of such fragments as can be found in a workshop, yet it is a better air gun than any I have ever seen.

Recently I offered a badge of distinction to any of my scouts who could go into the woods, make his own tools, and with them fashion a practical Indian arrow from the material found in the wood. Out of several hundred thousand scouts, one smashed a flinty stone against another stone, used a fragment for a knife, split and whittled out the arrow shaft, and then with the broken handle of a toothbrush, which he found in the path, he chipped a flint arrowhead. With a sinew from the body of a small mammal he had killed, he bound the flint arrowhead to the shaft. He feathered the shaft with feathers found in the woods and glued them on with the gum of trees.

Alongside of this boy, Robinson Crusoe was a veritable tenderfoot, a "Cheechako." It is this indomitable will and ability to make use of the material at hand that we are inculcating in the minds of the Boy Scouts of today.

NOW the lesson taught us by these examples is, that with gumption a man can make almost anything, using only hand-made tools. It is the primitive, forceful quality of human mind backed and strengthened by modern education that produces our Fords and Edisons. This quality of mind is one of the most valuable assets we Americans possess. It means success in business, in the professions, in statesmanship and science, and it can be summed up in the good old fashioned word, GUMPTION.



Slide Caliper Rule

A useful tool for close measurements. For especially fine adjustments, the final movement of the thumb slide is made by turning the knurled

adjusting nut. Reversing the slide, the tool can be used as a stop rule. Removing the slide provides a narrow hook rule. The tempered steel rule is 6 inches long, $\frac{3}{8}$ inch wide, $\frac{1}{20}$ inch

thick, with either No. 10 or metric graduation. Packed one in a pasteboard box, weight 2 ounces. Price \$3.50. Slide Caliper Rule, No. 1771, without the fine screw adjustment. Price \$2.50.

Save money, time, trouble

The amount of effort and expense involved in repairs and replacements around the house—the car—the radio—often depends on the accuracy of your measurements.

Hair-line precision on close work, a snug fit for all parts you buy—such as gaskets, petcocks, washers, bolts, nuts, screws, keys, and pins—absolute accuracy of every measurement for which a caliper slide rule and a trammel rule can be used, is insured by these two vest-pocket-size tools.

These good tools will be mailed guaranteed, postage-paid, to any point in the United States on receipt of the price.

GOODELL PRATT COMPANY, Greenfield, Mass., U. S. A.

Trammel Rule

A compact, handy trammel for all measurements within the capacity of the steel rule which forms the beam. The hardened steel

points can be set directly from the graduations on the steel rule. When describing circles the point at the left, with the flat top, is used as the center, and the point at the right the scribe.

The tempered steel rule is 6 inches long, $\frac{3}{8}$ inch wide and $\frac{1}{20}$ inch thick, with either No. 10 or metric graduation. Packed one in a pasteboard box, weight $1\frac{1}{2}$ ounces. Price \$2.50.



GOODELL-PRATT

1500 GOOD TOOLS

"More precious than rubies"—seems this smoking tobacco

Old smokers of Edgeworth delight in their friendly rivalries for length of attachment to their favorite brand, and for total poundage incinerated in their trusty pipes.

Mr. Dugan inaugurates another sort of competition—a sort of Long-Distance-Wait Contest. For this loyal Edgeworthian orders his favorite tobacco in May, and then goes on forage rations until August, rather than twist his tobacco taste to accommodate native varieties.

Read Mr. Dugan's letter and be thankful you're where you are!

Philippine Islands

Larus & Bro. Co., Richmond, Va.

Dear Sirs:—Enclosed please find money-order for \$4.65, for which please send me the following: 1—16 oz. glass jar Ready Rubbed; 1—\$1.50 can Qboid; 1—\$1.50 can Plug Slice.

Until recently I have been able to get Edgeworth from a dealer near here, but for the last month he has been "out," and I have been smoking native cigarettes and other so-called tobacco. I realize that it will be three months or so before I hear from this, but I know I'll get it sure by sending direct to you, you won't be "just out." In the meantime I may be able to scare up a little here and there. It's mighty hard to "bum" any Edgeworth from friends in this part of the world. They'd just about as soon give you the key to their safety deposit boxes as they would to the "Old tobacco box" where they keep their Edgeworth. I don't blame them; it's mighty hard to get, and it's terribly hard to go without. I know how the baby felt about the soap now: I won't be happy till I get my Edgeworth.

Yours, almost tearfully,
C. P. Dugan.

Let us send you free samples of Edgeworth so that you may put it to the pipe test. If you like the samples, you'll like Edgeworth wherever and whenever you buy it, for it never changes in quality. Write your name and address to Larus & Brother Company, 10M South 21st Street, Richmond, Va.

We'll be grateful for the name and address of your tobacco dealer, too, if you care to add them.

Edgeworth is sold in various sizes to suit the needs and means of all purchasers. Both Edgeworth Plug Slice and Edgeworth Ready-Rubbed are packed in small, pocket size packages, in handsome humidor holding a pound, and also in several handy in-between sizes.

To Retail Tobacco Merchants: If your jobber cannot supply you with Edgeworth, Larus & Brother Company will gladly send you prepaid by parcel post a one- or two-dozen carton of any size of Edgeworth Plug Slice or Edgeworth Ready-Rubbed for the same price you would pay the jobber.

The Home Workshop

Wallboard and Trim for Finishing an Attic Room

By Edwin M. Love

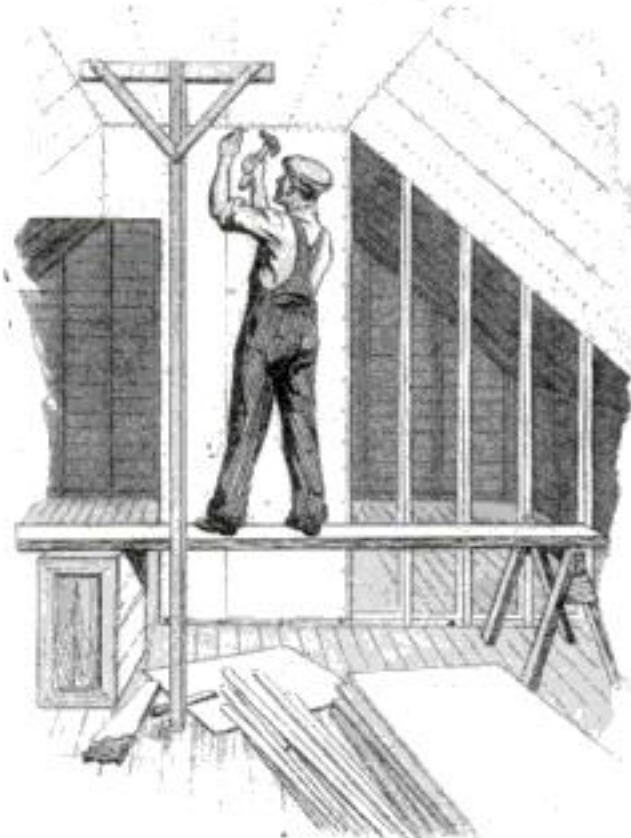
This is the fifth of a series of articles telling how to convert an unfinished attic into a comfortable room. Whether or not you wish to undertake a job of this kind, you will find invaluable pointers on home woodwork in each of the articles.

BECAUSE of its comparative cheapness and the ease with which it can be applied, wallboard is especially adapted for use by the home mechanic in lining an attic room.

Much wallboard is applied over frame walls just as erected, but to avoid humps and hollows in the walls it is advisable to test the studs with a straightedge for straightness and alinement. Irregularities may be planed out or shimmed, according to their nature.

At all angles and corners, blocks must be nailed between the rafters, ceiling joints, or studding, as may be necessary to carry the edges of the wallboard. Other backing blocks with their centers at the height of the baseboards, must be put in. Behind all light fixtures and outlets backing is required. This construction prevents pockets or sags behind the trim.

Wallboards fall into three classes—those consisting of a plaster or composition core with fiber faces, those built up of narrow widths of thin wood and faced with fiber, and those built up entirely of wood or cane fiber suitably compressed and treated to give rigidity with lightness. Each has its good points. The plaster board is fireproof and little affected by moisture, but is brittle and heavy. Fiber boards are tough and light, but they may



The wallboard is applied first on the ceiling and then is nailed against the wall studs.

buckle from absorption of moisture unless both sides are given a coat of paint before using, and they are not fireproof.

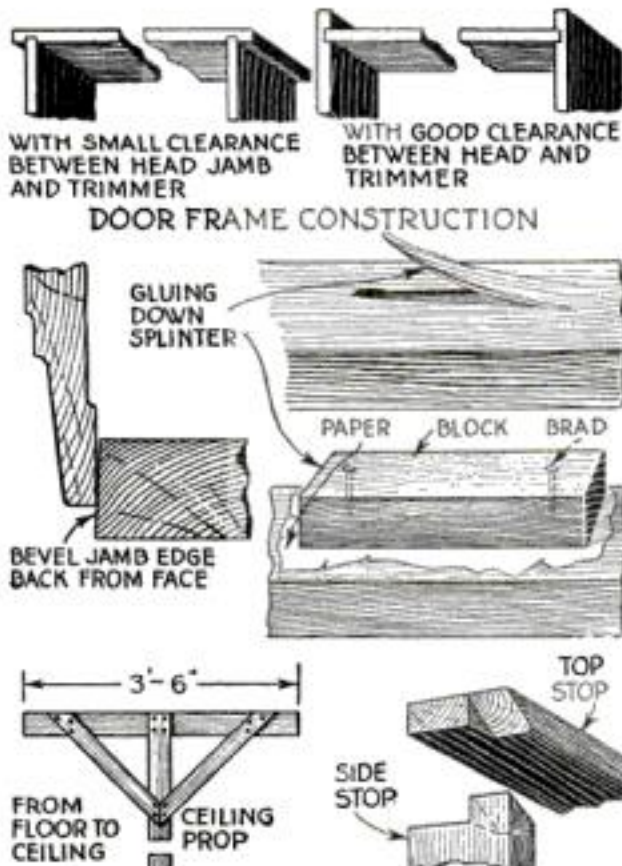
Before starting to put on wallboard, lay out the walls and ceilings for the panels, centering them, if possible, on the room or on spaces between openings, or otherwise planning for a balanced effect. Rather than have uneven panel widths, it is preferable to put in one or two extra studs where necessary.

Apply the board to the ceiling first, propping it up with one or two T-props made as detailed, and tacking the edges in a few places with flat-head nails. Strike white chalk lines to mark the centers of intermediate joists, and if the board used has a plaster center, nail every 3 in. with shingle nails. Take care not to leave hammer marks. Then nail the edge every 8 in. If fiber board is used, it is better to use patent clinching fasteners, which are nailed directly to the intermediate joists before the panel is put up. If you do use nails, drive 1-in. No. 16 wire brads every 8 in. and set below the surface for putting.

Apply the board to the walls by tacking the upper ends first, nailing the centers and then the edges. Leave the edges about 3/16 in. apart, unless the cracks are to be filled and the room is to be papered. In that case brads should be used on the edges instead of flat-head nails.

The first work in putting up interior trim is to fit the windows into the openings, so that the room may be closed up and moisture kept out. Cut off the projecting ends of the stiles from the casements and joint down the edges enough to allow the sash to be slipped

(Continued on page 100)



Suggestions for constructing door frames, cutting stops, gluing splinters, and making a prop

Try this Yardstick on YOUR Brain

MEASURE YOUR KNOWLEDGE with the POPULAR SCIENCE QUESTIONNAIRE

1. Why does radium continue to give out heat for thousands of years?
2. Are the stars solid like the earth?
3. How was the earth formed?
4. Why is glass transparent?
5. How do we know that the earth is slowly shrinking?
6. What is an electric current?
7. How was petroleum formed?
8. Do electrons really move through wire when an electric current is flowing through it?
9. What physical changes in your body are produced by fear?
10. How do muscles exert power?
11. What are X-rays?
12. Can we see atoms with a microscope?
13. Why does heat expand things and cold contract them?
14. Why does the moon appear to change its shape from time to time?
15. What is the brain made of?
16. Why is it possible that the inside of the earth is growing hotter instead of colder?
17. Why is frost more likely on a clear night than on a cloudy one?
18. Does thinking use up the thinker's energy?
19. Which travels faster, electricity or light?
20. What simple test will distinguish wool from cotton?
21. What makes the noise of thunder?
22. Why would men ultimately suffocate if all the green plants were killed?
23. Does the boiling of water remove the impurities in it?
24. How do the living cells of the body get the energy with which to do their work?
25. How is the speed of light measured?

TOTAL PERCENTAGE

EVERYBODY is talking about the famous "Popular Science Questionnaire." Doctors, Lawyers, Professors, College Graduates and thousands of others have tested themselves with this Questionnaire. In the panel is the list of questions of which the Questionnaire is composed. How many of them can you answer?

Like an Old-fashioned Examination

May we ask you to make this test carefully, reading the questions slowly and giving thought to each one? When you cannot answer one satisfactorily to yourself, put a zero (0) beside it.

On the other hand, give yourself credit of four (4) for each satisfactory answer. Then when you are through, see how near you have come to making a mark of 100.

This is like an old-fashioned examination, but you will find it fascinating. The questions all have to do with the wonders of the world we live in. All can be given quick and straight forward answers by any person of education.

All of the questions in the famous "Popular Science Questionnaire" and many hundreds of others, have now been answered, for the first time, in one book—THE POCKET GUIDE TO SCIENCE.

All that you probably ever will want to know about science is told in this one 284-page book that will fit in your pocket or grace a library table. Curiosity-satisfying facts about the world we live in are made instantly available to you in simple question-and-answer form in THE POCKET GUIDE TO SCIENCE.

You are assured of the accuracy of the answers in THE POCKET GUIDE TO SCIENCE because it has been edited by

Dr. E. E. Free, who has remarkable genius for condensing the known facts about scientific questions into easily remembered paragraphs.

SPECIAL OFFER

THE POCKET GUIDE TO SCIENCE is not for sale. It is offered to you without one penny extra cost with a 14 months' subscription to POPULAR SCIENCE MONTHLY.

POPULAR SCIENCE MONTHLY "carries on" from where THE POCKET GUIDE TO SCIENCE leaves off. THE POCKET GUIDE gives you all that the scientists have discovered up to right now—POPULAR SCIENCE MONTHLY will give you all the important, interesting and new discoveries of science for the next 14 months.

It takes over 300 articles and pictures every month to tell the readers of POPULAR SCIENCE MONTHLY all that has happened in the scientific, radio, mechanical and automotive fields.

Your Name in Gold

THE POCKET GUIDE TO SCIENCE is bound in beautiful flexible fabrikoid. We will stamp your name in 22-carat gold on the cover of THE POCKET GUIDE at no extra cost to you if you use the coupon below immediately.

We extend to you the Special Offer of a 14 months' subscription to POPULAR SCIENCE MONTHLY (regular price by the month would be \$3.50) with the THE POCKET GUIDE TO SCIENCE—all for \$2.95, plus the postage. If you are already a subscriber to POPULAR SCIENCE we will extend your subscription 14 months if you accept this offer.

Into this one brilliant book of 284 pages has been condensed the outstanding facts about the world we live in.

SEND NO MONEY

Send no money, just the coupon. If within 10 days after you receive the book and magazine you decide that you are not satisfied in every particular, you may return them, and your entire payment will be refunded promptly and without question. Could any offer be fairer?

POPULAR SCIENCE MONTHLY
250 FOURTH AVENUE NEW YORK

POPULAR SCIENCE MONTHLY
250 Fourth Avenue, New York

P. S. 1-26

I accept your offer of THE POCKET GUIDE TO SCIENCE and a 14 months' subscription to POPULAR SCIENCE MONTHLY. I will pay the postman \$2.95, plus the postage when he delivers the POCKET GUIDE and the first issue of POPULAR SCIENCE MONTHLY. If the book and magazine are not fully satisfactory to me I will return them within 10 days and you are to promptly refund my full payment. Please stamp my name in gold.

Name

Address

City

State

If you prefer send \$2.95 with your order



THE Beldenamel Aerial is not a trick aerial. It is a scientific achievement, endorsed by leading radio engineers.

Beldenamel Aerials are made of stranded copper. Each strand is coated with baked Beldenamel to protect the copper surface from corrosion. A Beldenamel Aerial cannot deteriorate. The signal strength and volume are constant, winter after winter, in spite of smoke and fumes in the atmosphere. No bare copper aerial can accomplish this result. For distance and volume, install a Beldenamel Aerial, today!

Sold by all
Leading
Radio
Dealers and
Jobbers



Belden

Send for Free Illustrated Booklet

Belden Manufacturing Company
2304-H So. Western Ave., Chicago

Please send me your latest illustrated booklet, free, describing Belden Products and their use in radio work.

Name

Address



AGENTS

Stamping names on Pocket Key Protectors; sample Check with your name and address, 25c. Stamping Outfits, Emblem Checks, Fobs, Name Plates.

HART MFG. CO.
305 Degraw St., Brooklyn, N. Y.

BURN YOUR NAME ON TOOLS WITH THE ARKOGRAF

Protect Your Tools From Theft. Write with electricity any name or design on the hardest and finest tools and instruments, or any metal, like writing on paper with pen or pencil. Complete Outfit \$3.50 Prepaid Anywhere. Interesting illustrated circular free. Write today. Agents wanted.

ARKOGRAF PEN CO.
1171-A East Stark St., Portland, Oregon

The Home Workshop

Wallboard and Trim for Attic

(Continued from page 98)

into the opening against the stops or bind-stop. It is secured for the time being with finishing nails tacked into the jambs.

The door frames are built of 1 by 6 in. stock jointed straight to the width of the studding, plus the thickness of the wallboard on each side, plus 1/16 in. for irregularities. Bevel the edges back from the faces slightly to insure a close joint between casing and jam.

Since there is little clearance between the head jam and head trimmer in the entrance to the typical attic room described in this series, the side jambs are dadoed into the head rather than the head into the sides. For a door 2 ft. 6 in. by 6 ft. 6 in., make the frame 2 ft. 6 in. by 6 ft. 6 1/2 in., inside.

To set the frame, block one side trimmer plumb and tack up one side of the frame to that trimmer, plumbing it carefully edgewise with straightedge and level. Cut a board to the width of the frame and lay it on the floor between the bottom ends of the side jambs to keep them parallel with each other and the right distance apart. With shingle points driven behind from both edges, wedge the other jamb straight and plumb, and nail solidly.

DO NOT neglect to level the head jamb carefully, cutting off the bottom of the long side if necessary. Nail up the other jamb, test for straightness, and correct irregularities with wedges driven from both edges. Then tack the stops in place.

The best type of stop for an attic room is the 3/8 by 1 1/2 in. round-edge door stop, as detailed. Some carpenters miter the joints between head and side stops, and some cope the sides against the head; but the best method is a combination of the two. Cut the head square on both ends to the exact length, miter the rounded edge to the depth of the mold, and split out the triangle so formed. Miter the mating end of the side stop and, following the corner of the obtuse angle, cut it square off from the back as far as the molding, as shown in the detail. Cut the stop 1/16 in. long and spring into place. The pressure will close the joint.

Since the thickness of the ordinary inside door is 1 3/8 in., the stops are placed 1 7/16 in. from the edge of the jambs, allowing clearance for paint; but the stops should not be nailed tight until after the door is hung and the lock fitted.

Next, cut to rough lengths all the finishing trim. Look it over for pitch pockets and rough places, and smooth up thoroughly. For work that is to be painted, small pitch pockets are allowable, though these must be cleaned out with a chisel and patched with a splinter of wood or a mixture of glue and sawdust.

If, in sandpapering, a splinter of wood is raised from the face or corner of the piece worked upon, lift it carefully, place glue under it, and clamp down by means of a small block tacked with brads, with a piece of paper underneath to prevent the glue from sticking it down.

"A Thousand Feet of Aerial Inside Your Home!"

—says a Baltimore fan

Effarsee
ANTENNAE
REG. U. S. TRADE MARK
PATENT PENDING

"Longer Range—More Volume Closer Tuning—Less Static!"

The new large Effarsee gives the equivalent of 1000 feet of aerial. Increased range, and volume, minimizes static and makes closer tuning.

Fixed Condensers Improve Reception!

Effarsee is scientifically designed to give local and distance reception at its best. Can be used inside or out—hung on walls or used rolled up.

Write for Reports from Users!

"Twice the range and more volume" says one. "Coast to Coast on the speaker" says another. Write for distance reports of enthusiastic users.

Type IXL (large) .. \$4.00

Type BXL (small) .. 2.50

At any radio dealers
—or write direct.



FISHWICK RADIO CO.
133 CENTRAL PARKWAY, CINCINNATI, O.

"DON'T SHOUT"

"I hear you. I can hear now as well as any body. 'HOW?' With THE MORLEY PHONE. I've a pair in my ears now, but they are invisible. I would not know I had them in, myself, only that I hear all right."

The Morley Phone for the **DEAF**

is to the ears what glasses are to the eyes. Invisible, comfortable, weightless and harmless. Anyone can adjust it. Over one hundred thousand sold. Write for booklet and testimonials.

THE MORLEY CO., Dept. 797, 10 S. 18th Street, Philadelphia

"Experiments With 110-Volt Alternating Current"

HERE at last is a book that gives a practical working knowledge of the alternating current. The only way to gain a thorough understanding of electricity is by direct personal experiment. How a practical knowledge of the alternating current can be gained in an interesting and inexpensive way is shown. The knowledge that comes from experiment is of vastly more value than that acquired from the performance of the stereotyped series of battery experiments usually described in books on Alternating Current.

The book "Experiments with 110-Volt Alternating Current" is needed by every man experimenting with alternating current.

256 pages, 135 illustrations. Price, postpaid, \$1.75

POPULAR SCIENCE MONTHLY
250 Fourth Avenue New York City



Home Workshop Chemistry

Simple Formulas that Will Save Time and Money

ORNAMENTAL papers, especially if they are a little out of the ordinary and cannot be duplicated in the arts and crafts shops, are in demand for all sorts of decorative purposes. They can be used for covering and decorating boxes and calendars, for lining books and for making attractive novelties.

A paper that has a frosted design can be made by using a saturated solution of Epsom salts (magnesium sulphate) in water. The solution is saturated when no more of the salt will dissolve in the water.

The liquid is brushed on a good grade of paper, Bristol board or cards, placed in



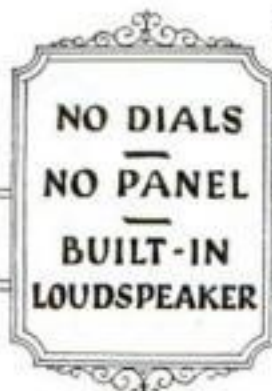
Ordinary paper or cardboard can be given an ornamental frosted surface simply by coating it with a saturated solution of Epsom salts. The crystallized surface will last indefinitely if protected with a thin alcoholic varnish

a horizontal position to dry. If thin papers are used, it is well to tack them to a drawing board so that they will not roll.

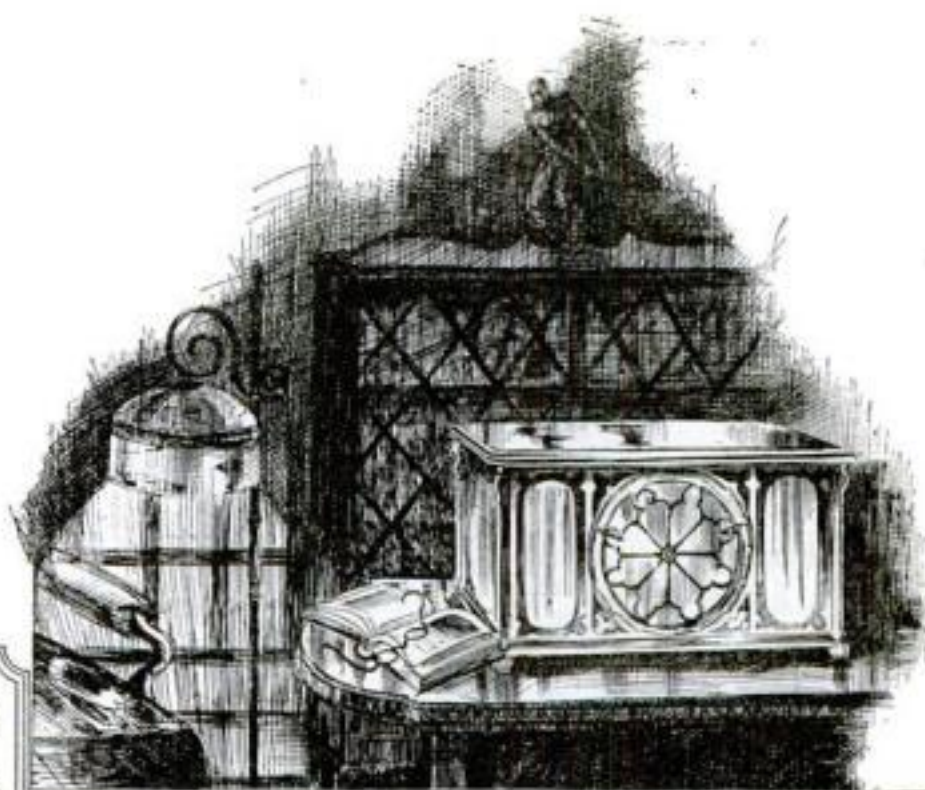
When the paper is dry, a frosted and crystallized deposit will be found on the surface. If it is wished to color these crystals, add a trace of dye or colored ink to the salt solution before applying it.

While this unusual design will last for some time, even if untreated, it can be made permanent with an alcoholic varnish of gum sandarac and denatured alcohol, to which a small amount of ozonized turpentine has been added. Writing or lettering can be done on the crystallized surface without destroying the decorative effect. For that reason the crystals make an interesting background for holiday cards.

SPECIALLY prepared paper may be used in forecasting the weather. Dissolve $\frac{1}{2}$ gram of cobalt chloride (not the nitrate) in 50 cc. of water and add 5 grams of gelatine. Heat slowly to dissolve and use the mixture to coat a sheet of blotting-paper. Normally the color of this paper will be pink, but it changes to blue in very dry weather and to a violet tone in moist weather.—ERNEST BADE, Ph.D.



To protect the public, Mr. Lacault's personal monogram seal (R. E. L.) is placed on the assembly lock bolts of all genuine ULTRADYNE Model L-3 Receivers. Guaranteed so long as these seals remain unbroken.



For the Well Appointed Home

UNOBTUSIVENESS with sufficiency—the rule of good taste—is the distinguishing grace of the ULTRADYNE Model L-3 Radio Receiver. It ushers in a new era of radio reception—a new, easier command of the air's treasures.

An artistic form of radio receiver that blends happily with every scheme of interior decoration. Pleases the eye with its charming lines, its beautiful two-tone mahogany cabinet, its fine proportions. Has the appearance of a decorative table-piece. Utter simplicity with superb receptive and reproductive qualities. Your local radio dealer will gladly give you a demonstration of this new modern receiver.

Write for illustrated folder giving full details.

ULTRADYNE MODEL L-3

The Ultradyne Model L-3 is a six-tube receiver employing the fundamental principles of the best circuits greatly refined and marvelously simplified.

\$135

West of Rocky Mountains \$140

PHENIX RADIO CORPORATION
114-A E. 25th Street NEW YORK, N. Y.

Diesel Engines Marine and Stationary By ENSIGN DAVID L. JONES, U.S. Navy

The most complete, thoroughly practical and up-to-date treatise on the Diesel Engine ever published. It explains their construction troubles, remedies, operation and adjustments, practical trials and tests and the elementary thermodynamics of all types of the Diesel Engine. The book is fully illustrated with drawings of working parts and detail engravings. 400 pages.

Price \$5.00

Popular Science Monthly
250 Fourth Avenue New York, N. Y.

AMAZING NEW ADDING PENCIL'S 3.

ADDS, MULTIPLIES, COUNTS, CHECKS

Adds as accurately as a \$100 machine. Convenient, rapid and useful. Carry like pencil or pen. Simply press pencil point on numbers; addition entirely automatic, instantaneous; total shows constantly. To clear, just swirl top. No larger than fountain pen. Not only adds, multiplies and counts with astonishing ease, but permits accurate checking. A remarkable time saver—infallible action. Adds as you write. Guaranteed for 5 years. **ORDER YOURS NOW.** We send Adding Pencil prepaid. On arrival pay postman only \$3.00, or if you prefer, send \$3.00 with order. In either case Adding Pencil is guaranteed to remain in perfect mechanical working order five years or we replace it free of charge. Send Now! **AGENTS** BIG money maker for free of charge. Everybody is interested. Write for our proposition. The Adding Pencil Co. 34 Arcade Bldg. St. Louis, Mo.



Always ready for immediate use..

COMFORTABLE old clothes, a sweet, cool pipe, good tools and a quiet room where you can make useful household articles, or just putter around, spells after-supper contentment and pleasure for thousands of men. And of course, glue is one of the tools you use most often.

Perhaps you have never thought of the special advantages of using LePage's Liquid Glue. It is always ready for immediate use. No weighing, soaking or heating is required. Its quality is always the same. It "sets" slowly enough so that you have plenty of time to place the joints together exactly as they should go. Slow setting also allows LePage's to penetrate the wood, increasing the strength of the joint. LePage's Liquid Glue is equal in strength to any animal glue. Buy a can for your workshop. It is the easiest, quickest, handiest form of Glue. Insist on LePage's.

RUSSIA CEMENT COMPANY
Laboratory and Factory

259 Essex Ave., Gloucester, Mass.

**LEPAGE'S
GLUE**
Bottles, Tubes, Cans

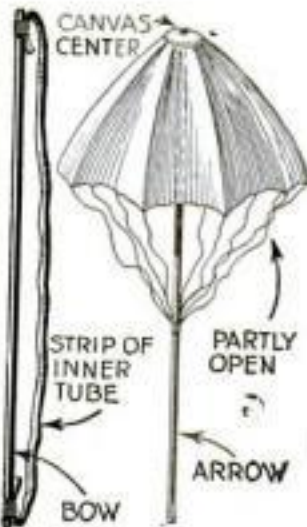
The Home Workshop

Bow Used for Shooting Toy Parachutes into the Air

SHOOTING arrow parachutes is a sport to thrill young bowmen who are looking for something novel in the way of archery.

Remove the cover from an old umbrella, being careful not to rip the cloth. Cut the cover around on a line halfway from the outside to the center so as to reduce its size and weight. Place a piece of stout canvas over the central hole and sew it securely in place.

For the arrow you will need a straight stick a little longer than the usual target arrow. It should be about 1 in. in diameter, tough and well seasoned. Wrap one end for about an inch with fine stout wire. Drive the points of the wire into the wood so that they cannot cut your hand.



How to make the parachute and bow

Fasten the center of the parachute to the stick with a small screw or a large carpet tack. Tie lengths of a strong fishing line to the corners of the cover and attach the cords to the arrow at about the halfway point. A small notch will keep the string from slipping.

If no strong bow is at hand, you can make one from a locust sapling 1 in. in diameter and a piece cut from an inner tube. The rubber should be 1 in. wide and one-third as long as the sapling. This combination makes a powerful bow.

After being shot vertically into the air, the parachute opens and the arrow descends slowly and gracefully to the ground.—H. E. WENRICH.

Paste for Imitating Carving

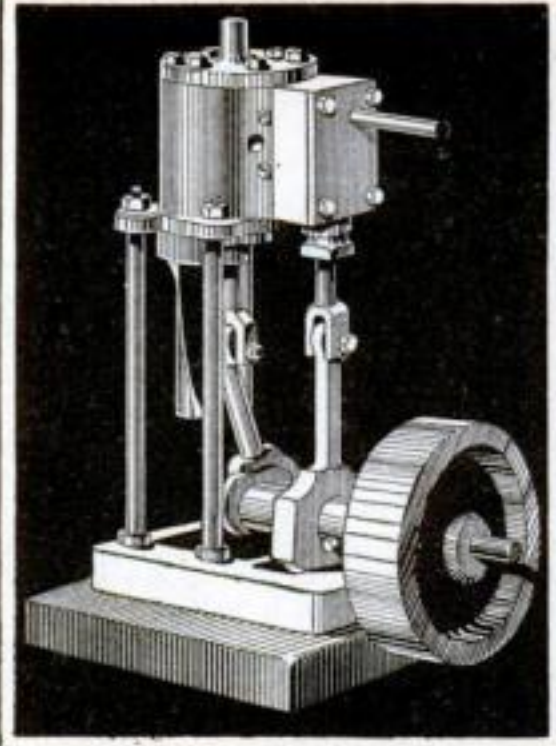
OLD picture frames, glove or work boxes and similar pieces may be decorated easily with imitation carving.

Rice is boiled in water to make a thick paste and mixed with starch to a dough-like mass, which is rolled into sheets, cut into squares, and allowed to dry.

A mold then is made. One simple method is to heat gutta-percha in warm water until sufficiently soft to be pressed over the carving that is to be duplicated.

Place the previously prepared squares between damp cloths until they are moist enough to be kneaded into a doughy mass and press the material into the mold.

The finished work, which looks very much like ivory, is glued in place.—W. J. E.



GET A HOBBY MAKE MODELS Start a Home Workshop

"Model Making," by R. F. Yates, describes the construction of model gas-engines, steam-engines, locomotives, boats, dynamos, turbines, railroads, guns, etc. Thirty chapters are devoted to models of various nature. It will help you to become a better mechanic. It will help you to do hard soldering, soft soldering, lathe work, tempering, drilling, pattern-making, etc.

This is a book every amateur or professional mechanic and model maker should have.

"Model Making" describes real engineering models, not toys. 432 Pages, 350 Illustrations. Practical, complete, easily understood. Price Postpaid, \$3.00.

POPULAR SCIENCE MONTHLY
250 FOURTH AVENUE, NEW YORK



TWENTIETH CENTURY BOOK OF Recipes, Formulas and Processes

This book of 800 pages is the most complete Book of Recipes ever published, giving thousands of recipes for the manufacture of valuable articles for every-day use. Hints, Helps, Practical Ideas and Secret Processes covering every branch of the useful arts are given.

10,000 Practical Formulas—The Best Way to Make Everything

A book to which you may turn with confidence that you will find what you are looking for. A mine of information, up-to-date in every respect. Contains an immense number of formulas that every one ought to have, that are not found in any other work.

Price \$4.00

Popular Science Monthly
250 Fourth Avenue, New York

The Home Workshop

We Make a Winged Toboggan

(Continued from page 72)

it would take a rather high rate of insurance.

Harley and I dragged it up the mountain the next afternoon to our preferred starting point, which was about 500 ft. above the camp. He had bargained to try it first. But I liked Harley Tryon, and inasmuch as the idea and workmanship had all been my own, my conscience became apprehensive. I was afraid to try it first; so was he, though neither of us would admit it to the other then, although we did later.

We flipped a coin, and it was still his turn first. But suppose the thing actually did fly and had a crash! I hated to think of all that work being lost in a first flight crash, and I wouldn't get a chance to ride it. So we compromised and decided to ride it together the first time down. We should have preferred also to compromise on the distance of the first tryout, but could not, because the mountain was so steep that we had to go up to this certain point in order to get a footing to climb aboard.

Harley always had ridden behind to do the steering. We took the same position; although now I was in the "cockpit," and couldn't roll clear of the thing if it became necessary or desirable.

WE CLIMBED on. That hill never had looked so high and steep, nor the frozen crust so hard and smooth.

"Are you ready?" Harley called. I answered, and we started.

The pick-up was immediate and terrific, with the sensation in the stomach of going down in an elevator. Faster, faster! The tears were streaking across my temples from the icy wind. I couldn't breathe, or at least didn't, in the excitement. Only one thought remained—*hang on!*

Two-thirds down we struck a small drift, and for a hundred feet beyond, though it was less than half a second in time, there was no sound of the toboggan's scraping the frozen snow. At the speed we were going the actual lift was small, but the fact that it actually had lifted us for a 100-ft. jump was demonstrated by our tracks.

At the bottom of the hill was a lake, 1000 ft. across, frozen and covered by 20 ft. of snow or more. We coasted across this flat to the far side, started up the opposite hill, and soon stopped.

The next time Tryon went alone. He sat well forward in the cockpit, and half-way down the hill there were unmistakable signs that the *Dragonfly* was going to leave the ground. When Harley reached where the bottom should have been, he was 10 ft. off the ground going like a shot. He landed straight and even, and finally came to a stop.

After that we alternated rides, with more or less good natured rivalry for height, distance, and near-accident risks. The sport never became dull. It was never even reasonably safe on such steep hills. It never failed to offer a

(Continued on page 104)

Pure Quality

"Man!—of all the beautiful, round and full tones, this is the cat's pajamas! Well, folks, I'm Daven until death do us part!"

A Newspaper Radio Editor.

For Neutrodyne Sets

"Your resistance coupled amplifier is certainly all that you claim for it. I would not hesitate a moment to recommend it to anyone who wants real quality without distortion. I did not find it necessary to use high voltage to get all the volume I wanted either, on a six tube Neutrodyne."

A Neutrodyne Fan.

For a Super-Heterodyne

"I am using three steps of Daven amplification with wonderful results. The outstanding characteristic is large volume. This feature is very desirable when used on a Super-Heterodyne as I am using it."

A Professional Operator.

Two Converts

"I followed your advice and put in another coupler instead of a transformer. I'm more than pleased. No more transformers for me! Your method of amplification is better, cheaper, and easier to assemble than any other."

From the Mid-West.

"Yesterday I got another Daven Unit and hooked it up. It would take some PULL to pry it away from me. Have a regular set now. I fail to see how anyone can stick to transformers after hearing music come through your way."

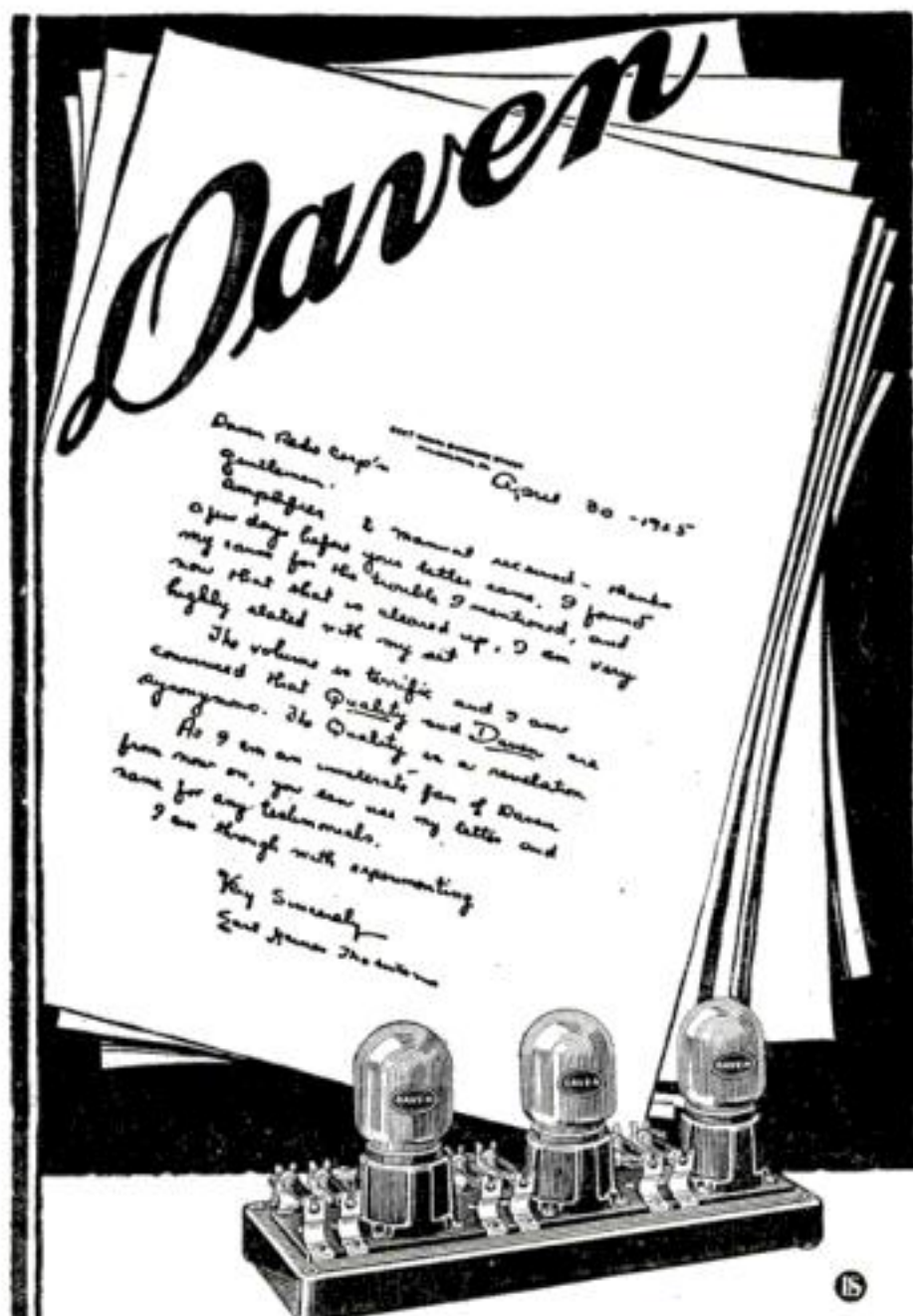
A Satisfied New Yorker.

Quality Succeeds Distance

"After spending much money on sets trying to get DX, I gave up in disgust and concentrated my efforts to produce quality reception with freedom from distortion; and at last I've got it using your Resistance Coupled units."

From the Pacific Coast.

NAMES FURNISHED UPON REQUEST



"QUALITY AND DAVEN ARE SYNONYMOUS"

"The Quality is a revelation." "Man!—of all the beautiful, round and full tones, this is the cat's pajamas." "The volume is terrific." Unnecessary to use high voltage to get all the volume I want." These are actual phrases Daven quality radio fans have written us.

Ask to see the Daven Super-Amplifier. It is for set owners who want more volume without distortion, and set builders who want Resistance Coupled Amplification without the labor of assembly. For greater amplification in resistance coupled amplifiers, use the new Daven Tube MU-20. Type MU-6 is for last or output stage of any set.

Daven products are sold only by good dealers

"The Sign of Merit"

DAVEN RADIO CORPORATION

Resistor Specialists

NEWARK Reg. U. S. Pat. Off. NEW JERSEY



DAVEN RADIO CORPORATION
161 Summit St. Newark, N. J.
Please send me the following on Resistance Coupled Amplification:
Check ☐ Resistor Manual
Here ☐ Complete Catalog (free).

Name _____

Address _____

For Dealers:

Send your letterhead or card,

or this coupon and we will have our nearest distributor communicate with you.

THE BIG LITTLE THINGS OF RADIO

SEE—

the big Prize Offer on
page 4 of this issue

**DOUBLES
HIS MILEAGE
and Makes \$120
A DAY**



J. M. James recently installed an amazing new device on his car which actually doubled his mileage per gallon and brought him the astounding profits of \$120 in just one day! This wonderful new invention makes practically any car give twice its regular mileage—many go 37 to 57 and 60 miles on a gallon.

Earn \$250—\$500 a Month

Many earn big money just telling your friends about this startling new device. Vernon Gaines made \$94 in one day—J. W. Cronk \$51 in one hour! The demand is enormous—20 million car owners want this amazing invention the instant they see it. Others make \$250—\$500 a month in full or spare time. And now the inventor will gladly send you a sample at his own risk! Write today to J. A. Stransky, A-730 Stransky Building, Pukwana, South Dakota.

Send for
this 84
Page
Book



This
Book
Has
Shown
3187 Men

How to Make More Money

Sell radio, spare time—evenings. A demonstration means sure sale. Whip any competition—longest distance possible—lowest prices—big commissions. No selling or radio experience necessary. 12 sales lessons and 10 radio service lessons FREE. Local ads, attractive booklets and letterheads with your own name. Exclusive territory to proven men. Start right now to build a permanent business of your own.

\$100 Weekly in Spare Time

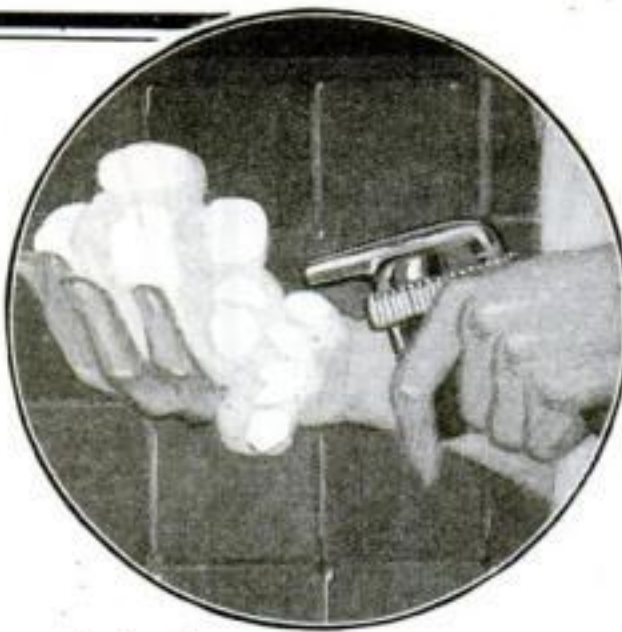
Many representatives making from \$50 to \$100 weekly, working evenings—you can do the same. Our 84 page Ozarka plan will prove it—FREE copy for those who ask for Book No. 100. Better write today—territory going fast—only plan of its kind—a proven success for four years. Don't fail to give name of your county.

OZARKA, Inc. 120 Austin Avenue R,
Chicago, Illinois

Better lather, easier shaving from the Latherizer Or your money back

A CLEAN, accurate lather-making machine, now displaces the inaccurate, mussy shaving brush. Try the nickel-plated Latherizer 10 days. If you return it, the full purchase price is refunded at once. The 10 days' use and soap have cost you nothing.

Operated by the squeeze of the bulb, the Latherizer, in a metal chamber, mixes the right amount of air, water and soap for the perfect lather, passes it through a metal screen, presents it to you through a spout ready-to-shave with. This is truly aerated, water-impregnated lather so fine in texture it needs no rubbing-in. It



speeds shaving.

The Latherizer saves you money because it saves on soap and outlasts many brushes. It saves time in both shaving preparation and shaving itself. And it saves the face.

Noted barber shops use the Latherizer. So do thousands of men, travelers especially. All welcome it as one of the biggest shaving improvements.

THE LATHERIZER CORP.,
Dept. B1, 452 Fifth Avenue, New York.

Gentlemen: Under your guarantee to refund the full purchase price, if I return the Latherizer complete after 10 days of use, you may send me the Latherizer (3 slugs of soap included). I enclose \$5 (check, currency, P. O. Money Order). If I return the Latherizer I will not be charged for any of the soap (1 cake) used in the trial, and will receive back at once the full \$5.

Name.....
Address.....
City.....State.....

Retailers:-

Soon the Latherizer and soap refills will be sold through retail channels only. Sales will be backed by big national advertising campaign. Write now for terms and facts which will reveal to you one of the biggest propositions in the history of merchandising.

THE LATHERIZER CORP.
Dept. B1, 452 Fifth Avenue
Retail Promotion Dept.
New York City

A new Parks! Cabinet Shop Special

No. 7

\$250



THE MOST POPULAR MACHINE PARKS EVER BUILT! A winner from the start. A real machine, yet convenient size for the small shop. Does everything in woodworking. Has circular rip and cut-off saw, 6-inch jointer, 16-inch bandsaw. Lathe and shaper attached if desired at small cost. Operates from any light socket. Just plug in and go to work.

Write for interesting circular

The Parks Ball Bearing Machine Co.
1547 Knowlton St., Cincinnati, Ohio
Canadian Factory: 200 Notre Dame East, Montreal, Canada

PARKS
WOODWORKING MACHINES

An Easily Made Smoking Cabinet

EVERY man who works with tools—whether he is a novice or a "handyman" with long experience—will find it easy to build this handsome smoking cabinet.

Space for cigars, cigarettes, match boxes, cigar and cigarette holders and pipe cleaners are provided. A feature that every smoker—and his wife—will appreciate is the ash trays (which are removable) at both ends of the cabinet. When not in use these ash receptacles can be closed.

Blueprint, including full details for making this handsome smoking cabinet, can be secured by sending 25c to—

Popular Science Monthly
250 Fourth Ave.
New York



The Home Workshop

We Make a Winged Toboggan

(Continued from page 103)

new kick in each descent, or flight, as you please.

Fifteen feet off the ground was perhaps the maximum attained, but considering the speed and the construction of the machine, that was plenty.

Between 25 and 30 trips were marked up before the crash. Confidence and the almost inevitable contempt of danger through familiarity, brought the sport to a sudden finish.

It was early in April, 1925, three months before any signs of spring appear at that altitude, when the *Dragonfly* made its last flight. A light, gusty wind was blowing. Harley went down the first trip, and after coming back up the hill warned me to look out for the breeze.

I sat as far forward as I could upon starting, and the irregular air pressure on the way down made me hesitate, but it was too late. When nearly to the bottom I slid back, but I had waited too long and slid back too far. The front of the machine raised to a horizontal position, and then kept right on going up.

I had some recollections of bending my head back and seeing the snow above me, about 20 feet away, and then we started for each other, the snow and I. The next I remember, some one was pulling on one of my legs, which were the only part of me I could move. Everything was crammed with snow—eyes, ears, nose, mouth, collar, and I couldn't get my breath. Harley told me later that the toboggoplane had just kept right on rising, and when well upside down I had left it and plunged head first through the crust into the snow.

Something like that must have happened for my face was like a piece of raw beef-steak for two weeks. I was thankful that the crust had broken at all, as it was hard enough to support the heaviest man without giving way.

The *Dragonfly* came down sideways and crumpled a wing. The next few days we stayed inside, and a snowslide came crashing down our favorite speedway, which closed toboggoplaning for the season—perhaps forever.

While there is no question about the danger of making one of the toboggoplanes for use on mountains such as Mr. Keating describes, the addition of wings to a toboggan will add immensely to the sport of coasting on ordinary hills. The toboggan skims along the snow much as a hydroplane rides on the water, and at moderate speeds there is no danger of its rising far in the air.

Glycerine and Alcohol Prevent Frost Forming on Glass

THE formation of frost on windows can be reduced materially by rubbing the inside of the glass with a solution of glycerine and alcohol. The solution is made by dissolving a teaspoon of the glycerine in half a pint of alcohol. Apply the mixture to the glass with a clean rag.

The Home Workshop

Common Corks Used in Making Stands for Glassware



IN ANY home workshop, kitchen, or laboratory where flasks, jars, and porcelain-ware are filled with hot liquids, the danger of breakage may be lessened greatly by the use of a stand made by fastening corks with glue and nails to a wooden baseboard.—J. H. SCHALEK.

Sharpening Your Skates

(Continued from page 82)

Hollow filing is a little more difficult, but it can be accomplished with the tool illustrated in Fig. 4. A round file of large enough diameter to cut a very shallow depression in the length of the runner is essential. Cut two hardwood blocks about $\frac{3}{4}$ in. thick, $1\frac{1}{4}$ in. wide, and 4 in. long. Make notches near one edge to take the file and then fasten the blocks securely to a third piece, the top, so that the space at the bottom forms a slot that will slide closely over the thickness of the skate runner. The file can be held in the blocks by a setscrew or a bolt fitted down through the top. Fit the appliance over the skate and sharpen the

runner by pushing forward just as if you were planing a board.

Where an emery wheel can be used, an excellent job of hollow grinding can be done with the jig shown in Fig. 5. This fixture is nothing more



Fig. 6. Two types of holders for files

than a vertical piece of board fastened rigidly to a baseboard. The top edge of the vertical piece then is cut out to fit snugly in the openings of the skate frame. A steel plate is drilled so that it may be fastened over the skate with screws. It should be arranged so that the runner will come halfway up the cutting face of a 4- or 5-in. emery wheel.

By pressing the runner lightly against the rapidly revolving wheel and moving the jig along from side to side, a professional job of hollow grinding will result.

Figure 6 shows in detail the blocks used in Figs. 3 and 4.

Use only the best quality files for skate sharpening. An 8- or 10-in. mill bastard file usually is chosen for this work.

The moustache, the beard and the bustle are hopelessly out of date. But no more so than the obsolete slow 2-ampere battery charger!

Buy nothing but an up-to-date 5-ampere charger!

The New Improved
5 AMP. A & B
GOLD SEAL
HOMCHARGER
\$19.50



Over 500,000 already in use

Modern-Fast-Efficient

NOW you don't have to wait for days while your battery charges. The new 5-ampere GOLD SEAL HOMCHARGER charges A or B batteries three times as fast as last year's slow chargers - - - it fully charges the average radio battery OVERNIGHT!

This year when you buy a battery charger, be sure it is a modern fast charger - - - one that charges at 5-amperes. To be absolutely sure, insist on the 5-ampere GOLD SEAL HOMCHARGER.

Free Write for new edition of our interesting 16-page booklet "The Secret of Distance and Volume in Radio."

THE KODEL RADIO CORPORATION
500 EAST PEARL ST. CINCINNATI, OHIO

WKRC
Owners of Kodel Broadcasting
Station WKRC.

\$100 in Cash Prizes

See Page 4 in
front of book
for details

**I Made \$21.00
In Five Hours**

—Writes Peter Werner, III.
Sell Madison "Better-Made"
Shirts for Large Manufacturer
Direct to wearer. No capital or
experience needed. Many earn
\$100.00 weekly and bonus.

Write for Free Samples

MADISON SHIRT M'FRS, 562 Broadway, New York

Big Value for 10 Cts.



6 Songs, words and music; 25 Pictures
Pretty Girls; 40 Ways to Make Money;
1 Joke Book; 1 Book on Love; 1 Magic
Book; 1 Book on Letter Writing; 1 Dream
Book and Fortune Teller; 1 Cook Book;
1 Base Ball Book, gives rules for games;
1 Toy Maker Book, Language of Flow-
ers; 1 Morse Telegraph Alphabet; 12
Chemical Experiments; Magic Age
Table; Great North Pole Game; 100
Conundrums; 3 Puzzles; 12 Games;
30 Verses for Autograph Albums. All
the above by mail for 10 cts. and 2 cts.
postage.

ROYAL SALES CO., Desk 115, Norwalk, Conn.



"Which Man Shall I Promote?"

WILL your employer think of you when the next good position is open? Will he say, "There's a man who is training himself to handle bigger work," or will he pass you by as just an ordinary routine worker?

Do not try to fool yourself. Your employer is watching you more closely than you may think. He's constantly checking up on your work, your abilities, your ideals, your aspirations. Stored away in the back of his mind or filed away in black and white, are his impressions of the kind of man you are and the kind of man you want to be.

He's willing and anxious to pay you more money the minute you prove that you are worth more money. But he can't take chances. When he promotes a man, he wants to be sure he will make good.

Decide now—today—that you are going to be ready when your chance comes. Choose the position you want in the work you like best—then train for it. You can do it in spare time in your own home through the International Correspondence Schools.

Write today for an interesting descriptive booklet which tells the full story. It won't cost you a penny, but it may be the means of changing your entire life.

INTERNATIONAL CORRESPONDENCE SCHOOLS

Box 7676-D, Scranton, Penna.

Oldest and largest correspondence schools in the world

Without cost, please tell me how I can qualify for the position or in the subject before which I have marked an X:

BUSINESS TRAINING COURSES

- | | |
|---|---|
| <input type="checkbox"/> Business Management | <input type="checkbox"/> Salesmanship |
| <input type="checkbox"/> Industrial Management | <input type="checkbox"/> Advertising |
| <input type="checkbox"/> Personnel Organization | <input type="checkbox"/> Better Letters |
| <input type="checkbox"/> Traffic Management | <input type="checkbox"/> Show Card Lettering |
| <input type="checkbox"/> Business Law | <input type="checkbox"/> Stenography and Typing |
| <input type="checkbox"/> Banking and Banking Law | <input type="checkbox"/> Business English |
| <input type="checkbox"/> Accountancy (including C.P.A.) | <input type="checkbox"/> Civil Service |
| <input type="checkbox"/> Nicholson Cost Accounting | <input type="checkbox"/> Railway Mail Clerk |
| <input type="checkbox"/> Bookkeeping | <input type="checkbox"/> Common School Subjects |
| <input type="checkbox"/> Private Secretary | <input type="checkbox"/> High School Subjects |
| <input type="checkbox"/> Spanish | <input type="checkbox"/> Illustrating |
| <input type="checkbox"/> French | |

TECHNICAL AND INDUSTRIAL COURSES

- | | |
|---|--|
| <input type="checkbox"/> Electrical Engineering | <input type="checkbox"/> Architect |
| <input type="checkbox"/> Electric Lighting | <input type="checkbox"/> Architects' Blueprints |
| <input type="checkbox"/> Mechanical Engineering | <input type="checkbox"/> Contractor and Builder |
| <input type="checkbox"/> Mechanical Draftsman | <input type="checkbox"/> Architectural Draftsman |
| <input type="checkbox"/> Machine Shop Practice | <input type="checkbox"/> Concrete Builder |
| <input type="checkbox"/> Railroad Positions | <input type="checkbox"/> Structural Engineer |
| <input type="checkbox"/> Gas Engine Operating | <input type="checkbox"/> Chemistry |
| <input type="checkbox"/> Civil Engineer | <input type="checkbox"/> Pharmacy |
| <input type="checkbox"/> Surveying and Mapping | <input type="checkbox"/> Automobile Work |
| <input type="checkbox"/> Metallurgy | <input type="checkbox"/> Airplane Engines |
| <input type="checkbox"/> Mining | <input type="checkbox"/> Agriculture and Poultry |
| <input type="checkbox"/> Steam Engineering | <input type="checkbox"/> Radio |
| <input type="checkbox"/> Mathematics | |

Name..... 6-26-25

Street.....

Address.....

City..... State.....

Occupation.....
If you reside in Canada, send this coupon to the International Correspondence Schools Canadian Limited, Montreal

Aviation

Take a W. A. C. Course in Applied Airplane Engineering. Many men earn \$2000 to \$10,000 a year. Big Free outfit of airplane parts. Write for Free catalog.

WESTERN AIRPLANE CORPORATION
Dept. P-1 Monadnock Bldg., Chicago, Ill.

CORONA FOUR

With standard office keyboard—an office typewriter in portable form.

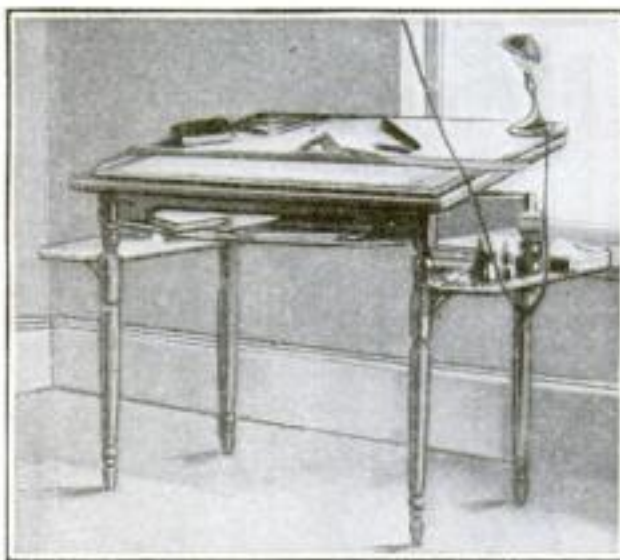
Write for literature.

Corona Typewriter Co., Inc.
112 Main St., Groton, N. Y.

The Home Workshop

Drawing-Table for the Home

EVERY home mechanic, no matter if he specializes in wood or metal-working, often has occasion to make a working drawing, sketch, or layout. For such work it is helpful to have a well equipped drafting-table. A good model is that illustrated, which is remarkably rigid, considering how light the construction is. When not needed for drafting, it



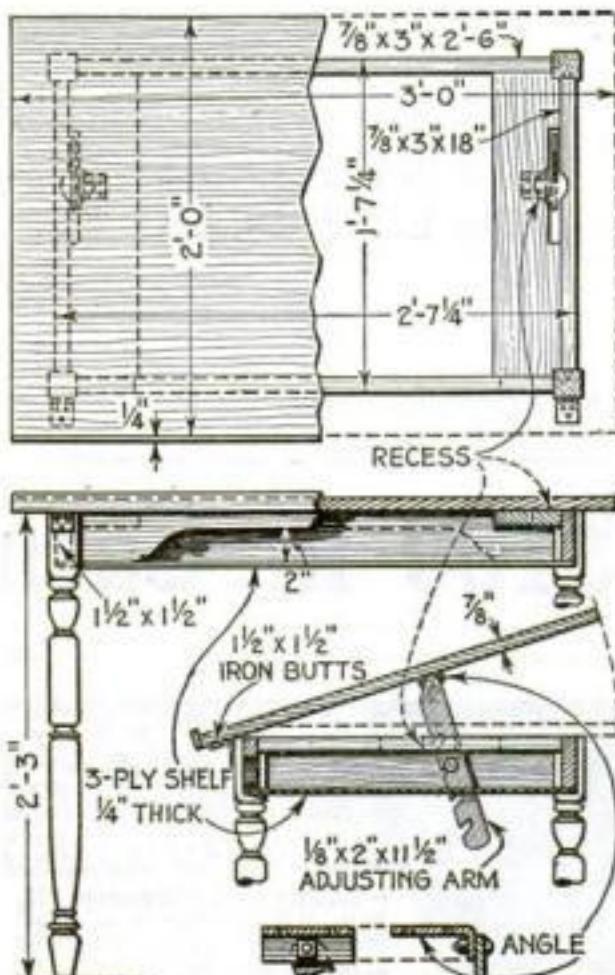
This adjustable table has storage space for all the materials used by a home draftsman

will serve other purposes, as the top can be dropped flat.

The table is constructed of any soft, clear wood obtainable or an unfinished kitchen table can be purchased for a few dollars and remodeled.

The side and end rails are constructed from 1-in. stock dressed to $\frac{7}{8}$ in. and are all 3 in. wide. Each end rail is 18 in. long and has a tenon cut at each end to fit a corresponding mortise cut in the legs.

(Continued on page 107)



Top and front views of the table and end section showing the adjusting mechanism

THAT WET BOILER PIT CAN BE MADE DRY!

MAKE and keep your cellar walls, floor and boiler and drain pits thoroughly dry by filling the cracks and coating the surface with Smooth-On No. 7, the only practical waterproofing material that can be effectively applied from inside and bonds perfectly on wet or dry surface. Excellent also for patching concrete floors, waterproofing garage, stable and washroom floors, brick walls, cisterns, septic tanks, water troughs, fountains, fish ponds, swimming pools, manure pits, etc.



Write for **FREE BOOK**

Requires about 25 lb. Smooth-On per 100 sq. ft. of surface and you can do the work yourself.

Sold in 5- and 10-lb. cans
25-, 50- and 100-lb. kegs

SMOOTH-ON MFG. CO.

Dept. 60

574 Communipaw Avenue
JERSEY CITY, N. J.



Do it with
SMOOTH-ON No. 7



STUDEBAKER 21 Jewels
The Insured Watch

ONLY \$1.00! The balance in easy monthly payments. Buy a Studebaker, the lifetime watch. 21 Jewels, 8 Adjustments including best, cold, isochronism and 5 positions. A supreme Watch value. Write for Style Book showing 60 newest, thin-model designs. Sent FREE!

Chain FREE Special offer. Write while offer lasts. Get beautiful style book in colors FREE!

STUDEBAKER WATCH CO., Dept. E-23 South Bend, Indiana
Canadian Address: Windsor, Ontario



FREE Book on Deafness

Write today for 168 page **FREE** book giving full particulars and testimonials from hundreds of grateful users whose hearing has been restored by use of our "little wireless phones for the ears."

Wilson Common-Sense Ear Drums require no medicine but effectively replace what is lacking or defective in the natural ear drums. They are simple devices, which the wearer easily fits into the ears where they are invisible. Soft, safe and comfortable.

WILSON EAR DRUM CO., Incorporated
281 Todd Building LOUISVILLE, KY.

The Home Workshop

Fitting a Violin Bridge

ALTHOUGH a violinist usually goes to a violin-maker to have a new bridge fitted to his instrument, the work can be done by almost any one.

Place a piece of No. 000 sandpaper, as shown, with the abrasive side up, and move the bridge from side to side until the legs are sanded down sufficiently.

The curve of the bridge legs will conform to the curve of violin and will bear perfectly.

The distance marked 13 in. on the drawing, which shows full-size violin, should be $10\frac{3}{16}$ in. for a three-quarter-size instrument, and $10\frac{1}{16}$ in. for a half-size model.



Location of bridge

—GEORGE A. MOHL.

Drawing-Table for the Home

(Continued from page 106)

Dowels may be used in place of the mortise-and-tenon joints, if preferred.

Both side rails are 30 in. long and are joined to the legs the same way as the end rails. The front rail has a portion cut out as shown to provide access to a sheet of 3-ply veneer, which is fastened to the lower edges of the rails to serve as a shelf.

The legs are turned on a lathe or made straight, as desired. The rails and legs are assembled with a good grade of flake or liquid glue and after they are thoroughly dry, a strip $\frac{7}{8}$ by 4 by $17\frac{1}{2}$ in. is fastened in place at each end, flush with the rail tops. These pieces have mortises to provide clearance for the adjusting arms and the nuts that hold the arms to the angle irons fastened under the top.

A round-headed wood screw having a shank about $\frac{1}{4}$ in. in diameter and projecting $\frac{1}{4}$ in., is located in each end rail about midway between the edges and $10\frac{3}{4}$ in. from the outer edges of the front rail; it is to engage the notches on the adjusting arm.

The top is built up of $\frac{7}{8}$ -in. boards and is 24 by 36 in. A strip $\frac{1}{4}$ by 1 by 36 in. with its ends beveled, is secured to the front edge of the top to prevent the drawing-board from sliding off when the top of the table is inclined.

Two small iron angles made from $\frac{1}{8}$ -in.-thick stock are recessed into the top on the under side where shown and fixed with screws. Two $1\frac{1}{2}$ by $1\frac{1}{2}$ in. iron butt hinges also are located on the under side of the top. The two iron adjusting arms are made from $\frac{1}{8}$ -in.-thick stock and are secured to the angles located in the top by means of small, round-headed stove bolts.

The table shown in the photograph has a small auxiliary shelf $\frac{3}{8}$ by 6 by 24 in. on each end, supported on 4-in. pressed-steel shelf brackets and provided with a stop on the inside edge between the legs.

When completely assembled, the table is cleaned up with fine sandpaper and finished as desired.—W. J. E.

now we'll have clear music



NOT just a series of jumbled tones but clear music—that's what you have a right to expect from your radio set. And there is no surer way to achieve this expectation than switching to Magnatrons.

Magnatrons are the product of the oldest exclusive makers of vacuum tubes. Every known improvement naturally has been used; along every inch of the way experience has been the guide.

There's a Magnatron for every purpose. The DC-201A, the DC-199 (large or small base), the DC-120 (for super volume), and the Rex (for B eliminators) all list for only \$2.50 each

Write for your FREE copy of "Pot Pourri"—a snappy review of mirth and music—to Dept. "A" Connewey Electric Labs., Magnatron Bldg., Hoboken, N. J.



MAGNATRONS

Complete Factory Stock for Pacific Coast carried at Pacific Radio Labs., 256 S. Los Angeles St., Los Angeles, Cal.

\$100 in Cash Prizes

See Page 4 in front of book for details

WANTED

Railway Postal Clerks

\$1900 to \$2700 a Year

(All Postal Pay Just Raised)

Steady work. No layoffs. Paid vacations. Common education sufficient.

Travel—See Your Country
Mail Coupon today—SURE

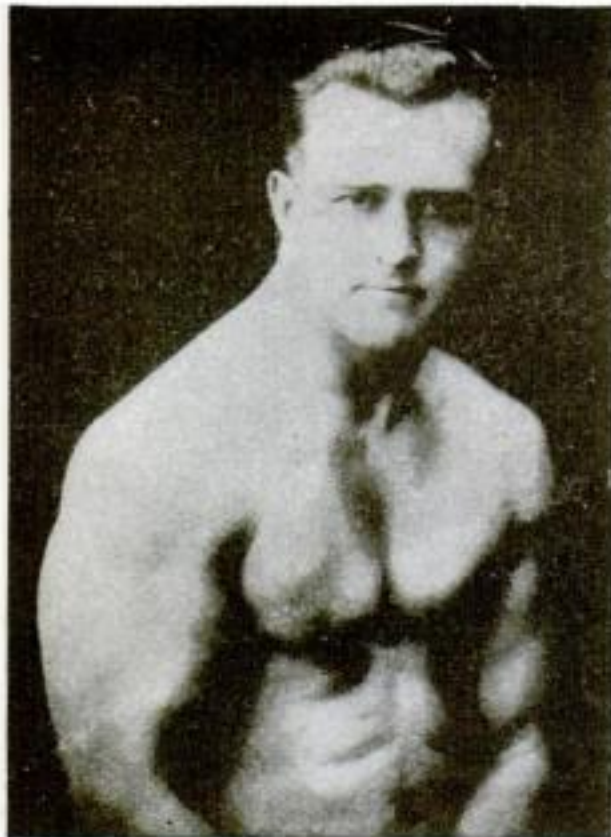


RAILWAY MAIL CLERKS

FRANKLIN INSTITUTE, Dept. K-276, ROCHESTER, N.Y.
Sir: I want to travel. Send me without charge (1) Specimen Railway Postal Clerk Examination questions. (2) List of other U.S. Government jobs now open to men and women 18 up. (3) Send free sample coaching.

Name.....

Address.....



EARLE E. LIEDERMAN

The Muscle Builder

Author of "Muscle Building," "Science of Wrestling," "Secrets of Strength," "Here's Health," etc.

KILL THIS MAN!

There's a devil inside of you. He's trying to kill you. Look out for him! He tells you not to work so hard. What's the use—the boss only piles more work on you. He tells you not to bother with your body. If you're weak—you always will be weak. Exercise is just a lot of rot. Do you recognize him? Of course you do. He's in us all. He's a murderer of ambition. He's a liar and a fool. Kill him! If you don't, he will kill you.

SAVED!

Thank your lucky stars you have another man inside of you. He's the human dynamo. He fills you full of pep and ambition. He keeps you alive—on fire. He urges you on in your daily tasks. He makes you strive for bigger and better things to do. He makes you crave for life and strength. He teaches you that the weak fall by the wayside, but the strong succeed. He shows you that exercise builds live tissue—live tissue is muscle—muscle means strength—strength is power. Power brings success! That's what you want, and goosh darn your old hide, you're going to get it.

Which Man Will It Be?

It's up to you—set your own future. You want to be the Human Dynamo? Fine! Well, let's get busy. That's where I come in. That's my job. Here's what I'll do for you.

In just 30 days I'll increase your arm one full inch with real live animated muscle. Yes, and I'll add two inches to your chest in the same time. Pretty good, eh? That's nothing. Now come the works. I'll build up your shoulders. I'll deepen your chest. I'll strengthen your whole body. I'll give you arms and legs like pillars. I'll literally pack muscle up your stomach and down your back. Meanwhile I'll work on those inner muscles surrounding your vital organs. You'll feel the thrill of life shooting up your old backbone and throughout your entire system. You'll feel so full of life, you will shout to the world, "I'm a man and I can prove it."

Sounds good, what? But listen! That isn't all. I'm not just promising these things. I guarantee them! It's a sure bet. Oh boy! Let's ride.

Send for my new book

"MUSCULAR DEVELOPMENT"

64 Pages and It's FREE

What do you think of that? I don't ask one cent. And it's the peppiest piece of reading you ever laid your eyes on. I swear you'll never blink an eyelash 'til you've turned the last cover. And there's over four dozen full-page photos of myself and some of my prize-winning pupils. This is the finest gallery of strong men ever assembled. And every last one of them shouting my praises. Look them over. If you don't get a kick out of this book, you had better roll over—you're dead. Come on then. Take out the old pen or pencil and sign your name and address to the coupon. If you haven't a stamp, a postal will do. But snap into it. Do it now. Tomorrow you may forget. Remember, it's something for nothing and no strings attached—no obligation. GRAB IT.

EARLE E. LIEDERMAN

Dept. 1301 305 Broadway New York City

EARLE E. LIEDERMAN
Dept. 1301, 305 Broadway, New York City

Dear Sir:—Please send me absolutely FREE and without any obligation on my part whatever, a copy of your latest book "Muscular Development." (Please write or print plainly.)

Name.....

Street.....

City.....

State.....

The Home Workshop

Operating a Model Railroad by Electrical Controls

(Continued from page 80)

are controlled electrically by eight push-buttons by the method described last month, it is possible to run two trains in opposite directions continually on either the outside or the inside track. The cross-overs, of course, act as sidings.

But you will need some control over the speed of the individual locomotives. In other words, you will have to be able to stop either train without interfering with the operation of the other one. Otherwise it would be impossible to run one train onto a siding and have it wait there while the other train goes by on the main line.

In Fig. 2 you will note, in addition to the track layout, that a switchboard is shown. This switchboard differs from the one you will need to control the track switches only in that switches to control the current to the track must be so built that you can leave them in either the open or closed position. They can be of ordinary porcelain-base, knife type, or if you wish to do an especially neat job, you can construct a panel with some of the push-pull or toggle switches sold as filament switches for radio sets.

WHEN all of the switches are in the closed position, current is being supplied to all sections of the track.

Assume, for instance, that you are operating two trains in opposite directions on the outside track. The buttons are pressed to throw the switches so that the train to reach the siding first will be switched onto it, and a switch is thrown, cutting off the current from the track of the siding. The train goes on the siding and stops. A button is pressed to close the main-line switch and the other train goes by. Then switches are closed and buttons pressed to bring the freight out on the main-line track again and speed it on its way.

Even if you do not attempt the construction of any electrically controlled switches, it will prove well worth while to install the sectional control of the track as shown in Fig. 2. Such problems as running two trains in the same direction on the same track are simplified greatly if you are able to cut off the current from any section of the track without disturbing the rest of the system.

Suppose, for example, that you wish to run two trains so that one follows another. Put the faster train in front and when it gets too far ahead of the second train, stop it at a station while the other train picks up the lost ground. Or you can keep the faster train just behind the slower train by momentarily opening and closing the switches controlling the current to the track sections over which the faster train is passing.

There are almost endless possibilities for the development of electric control for model railways and, luckily enough, the main requirement is time, since bell wire, knife switches, and other supplies, are quite cheap.

PRACTICAL BOOKS THAT WILL RAISE YOUR PAY

WRITTEN in easy-to-understand non-technical language these books will help you in your chosen trade. Every book is an entire course of instruction condensed into one volume. Thousands of men have used them to increase their pay. You will find them full of information and ideas that will help you raise your pay.

Painting and Decorating

Ross Crane Book of Home Furnishing and Decoration.....Cloth	\$3.00
House Painting Methods with the Brush and Spray Gun, by Vanderwalker, Cloth.....	\$2.00
Interior Wall Decoration, by Vanderwalker.....Leatherette	\$4.00
The Mixing of Colors and Paints, by Vanderwalker.....Cloth	\$2.00
A Show at Show Cards.....Cloth	\$4.00
Sign Painting, by Atkinson...Cloth	\$4.00
Strong's Book of Designs Leatherette.....	\$4.00
Modern Painter's Cyclopedia Cloth	\$2.00
Automobile Painting.....Cloth	\$1.50
New Hardwood Finishing....Cloth	\$1.50

Steam Engineering

Swingle's Handbook for Steam Engineers and Electricians. Leatherette	\$4.00
Examination Questions and Answers for Marine and Stationary Engineers. Leatherette.....	\$2.00
Steam Boilers.....Leatherette	\$2.00
Swingle's Catechism of Steam, Gas and Electrical Engineering. Leatherette	\$1.50

Carpentry Books

Cloth Binding	
Modern Carpentry, 2 vols.....	\$3.00
The Steel Square, 2 vols.....	\$3.00
Modern Estimator.....	\$1.50
Timber Framing.....	\$2.00
Builder's Architectural Drawing....	\$2.00
Concretes.....	\$1.50
Practical Bungalows.....	\$1.00
Roof Framing, by Van Gasbeek....	\$1.50

Electrical Books

Telephony, Including Automatic Switching, by Smith, 450 pp. Leatherette	\$2.50
Practical Applied Electricity.....	\$2.00
Wiring Diagrams and Descriptions	\$1.50
Armature and Magnet Winding....	\$1.50
Electric Motors, D. & A.....	\$1.50

CHECK

—the books you want and mail today with your remittance.

We will send you the books you order on our guarantee that if you are not thoroughly satisfied with them we will return your money.

POPULAR SCIENCE MONTHLY
250 Fourth Avenue
New York

POPULAR SCIENCE MONTHLY

Gentlemen:

Please send me the books I have checked for which I enclose my remittance of \$..... I am ordering these books on the basis that if I am not satisfied my money will be refunded.

Name.....

Address.....

The Shipshape Home

How to Lay New Floors

KEEPING the floors of a home shipshape is a perpetual problem, especially if the wood is of a poor and splintery quality, or if the floors have been abused or neglected. When the floors are in really bad shape, they must be relaid. Fortunately that is not a difficult job. It is one you can do yourself with a saw, hammer, and square, provided you are willing to take a little time and pains.

The popular material for wooden floors just now is oak, which makes a much finer looking surface than yellow or North Carolina pine, although it is more expensive. Maple also is used. My own preference is for oak, as I believe that the additional expense for material



can be disregarded when one is doing the work himself and consequently saving the cost of labor.

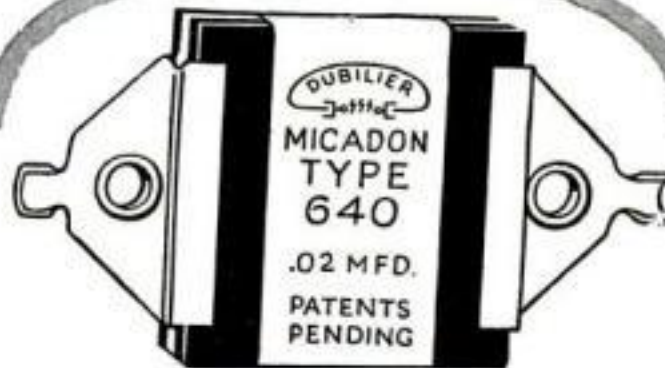
There are at least four thicknesses of flooring from which to choose. As your old floor probably is worn so unevenly as to have depressions here and there, it is better to use rather thick stock for the new floor to prevent the boards from springing. The $\frac{1}{2}$ - or $\frac{5}{8}$ -in. thickness is perhaps the most practical. In estimating your flooring at the $\frac{1}{2}$ - or $\frac{5}{8}$ -in. thickness, allow 50 per cent more than the actual area if the boards are to be $1\frac{1}{2}$ in. wide, or 33 $\frac{1}{3}$ per cent extra if they are $2\frac{1}{4}$ in. wide. The narrower flooring is, of course, the better.

Have the old floor dry. Do not mop it beforehand, but sweep it clean. Lay damp-proof paper over the old floor—not common building paper, but some kind that really will stop dampness from coming through.

Lay the new boards at right angles to the old floor boards, after nailing down as solidly as possible any loose or springy places in the old floor.

Start the first board by placing its groove to the wall after having removed the quarter-round or base-shoe molding. Do not, however, push the first board tightly against the base. Leave a space of $\frac{1}{2}$ in. to allow for any possible expan-

(Continued on page 110)



MICADONS

Found in famous radio sets

In radio sets that have earned fame and a reputation for quality, you will find Micadons—the foremost fixed condensers of radio.

Over 25 Million in Use

More than 25 million Micadons are today giving satisfactory service—they are found in 90% of all the radio sets in use.

The reason is

Dublier *knows* how to make efficient fixed condensers and their methods are fully protected by basic patents. Micadons are the result of twenty years intensive, scientific research.

Dublier

CONDENSER AND RADIO CORPORATION

FREE

140-page Book full of life-size ruled forms, each one completely filled in. The answer to problems of accounting and record keeping for any business or profession.

Send for this **FREE** Book today
John C. Moore Corporation
 (Established 1839)
 3052 Stone St., Rochester, N. Y.

MOORE'S LOOSE LEAF SYSTEMS

In Use In More Than 300,000 Offices

LOFTIS BROS. & CO. 1242

DIAMONDS WATCHES

DIAMONDS *Genuine Diamonds Guaranteed* WATCHES
 GIFTS **CASH OR CREDIT** GIFTS

The Diamonds in these Rings are brilliant, Blue White, high-grade Quality Gems. The mountings are Solid 18-k White Gold. Cased in handsome Ring box.

Diamonds Win Hearts—Win Her With a Diamond
 To Be Successful, Look Successful—Wear a Genuine Diamond

Send for Catalog
 Over 2,000 illustrations of Diamond-set Jewelry, Pearls, Watches, Wrist Watches, Mesh Bags, Silverware, etc. Sent prepaid for your Free Examination. Catalog explains everything.

We Invite Comparison of Quality and Prices
CREDIT TERMS: Goods delivered on first payment of one-tenth of purchase price; balance in equal amounts, payable weekly, semi-monthly or monthly at your convenience.

Money Back If Not Satisfied
 No. 49—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 50—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 51—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 52—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 53—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 54—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 55—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 56—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 57—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 58—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 59—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 60—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 61—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 62—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 63—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 64—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 65—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 66—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 67—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 68—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 69—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 70—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 71—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 72—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 73—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 74—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 75—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 76—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 77—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 78—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 79—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 80—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 81—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 82—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 83—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 84—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 85—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 86—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 87—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 88—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 89—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 90—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 91—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 92—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 93—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 94—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 95—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 96—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 97—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 98—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 99—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 100—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 101—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 102—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 103—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 104—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 105—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 106—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 107—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 108—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 109—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 110—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 111—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 112—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 113—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 114—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 115—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 116—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 117—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 118—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 119—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 120—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 121—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 122—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 123—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 124—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 125—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 126—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 127—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 128—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 129—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 130—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 131—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 132—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 133—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 134—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 135—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 136—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 137—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 138—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 139—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 140—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 141—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 142—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 143—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 144—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 145—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 146—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 147—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 148—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 149—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 150—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 151—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 152—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 153—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 154—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 155—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 156—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 157—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 158—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 159—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 160—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 161—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 162—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 163—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 164—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 165—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 166—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 167—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 168—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 169—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 170—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 171—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 172—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 173—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 174—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 175—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 176—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 177—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 178—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 179—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 180—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 181—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 182—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 183—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 184—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 185—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 186—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 187—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 188—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 189—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 190—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 191—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 192—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 193—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 194—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 195—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 196—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 197—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 198—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 199—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 200—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 201—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 202—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 203—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 204—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 205—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 206—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 207—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 208—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 209—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 210—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 211—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 212—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 213—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 214—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 215—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 216—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 217—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 218—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 219—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 220—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 221—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 222—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 223—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 224—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 225—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 226—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 227—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 228—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 229—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 230—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 231—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 232—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 233—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 234—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 235—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 236—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 237—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 238—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 239—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 240—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 241—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 242—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 243—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 244—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 245—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 246—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 247—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 248—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 249—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 250—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 251—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 252—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 253—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 254—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 255—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 256—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 257—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 258—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 259—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 260—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 261—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 262—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 263—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 264—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 265—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 266—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 267—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 268—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 269—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 270—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 271—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 272—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 273—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 274—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 275—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 276—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 277—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 278—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 279—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 280—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 281—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 282—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 283—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 284—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 285—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 286—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 287—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 288—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 289—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 290—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 291—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 292—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 293—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 294—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 295—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 296—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 297—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 298—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 299—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 300—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 301—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 302—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 303—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 304—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 305—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 306—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 307—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 308—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 309—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 310—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 311—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 312—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 313—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 314—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 315—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 316—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 317—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 318—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 319—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 320—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 321—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 322—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 323—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 324—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 325—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 326—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 327—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 328—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 329—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 330—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 331—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 332—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 333—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 334—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 335—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 336—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 337—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 338—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 339—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 340—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 341—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 342—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 343—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 344—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 345—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 346—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 347—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 348—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 349—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 350—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 351—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 352—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 353—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 354—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 355—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 356—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 357—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 358—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 359—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 360—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 361—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 362—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 363—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 364—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 365—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 366—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 367—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 368—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 369—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 370—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 371—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 372—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 373—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 374—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 375—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 376—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 377—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 378—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 379—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 380—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 381—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 382—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 383—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 384—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 385—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 386—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 387—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 388—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 389—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 390—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 391—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 392—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 393—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 394—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 395—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 396—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 397—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 398—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 399—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 400—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 401—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 402—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 403—Wrist Watch, Solid 18-k White Gold—\$35.00
 No. 404—Wrist Watch, Solid 18-k White Gold—\$35.00
 No.



Couldn't Play a Note — Now Makes \$100⁰⁰ a Week

"When I sent for your catalog, I didn't know a note of music. A few months after I bought my Wurlitzer instrument, I had taken my place in a professional orchestra. Now I am making \$100 a week, three times what I made as a clerk. I wish everybody knew how easy it is—anyone who can whistle a tune can learn to play a musical instrument."—Bill Carola.

Free Trial—Easy Payments

You may now have any Wurlitzer instrument for a week's free trial in your own home. Examine the instrument, note the fine workmanship, the full, rich tone value and especially how easy it is to play. No obligation to buy—no expense for the trial. We make this liberal offer because we want you to try for yourself a genuine Wurlitzer instrument, the result of 200 years' experience in musical instrument building.

Easy payments are arranged to suit your convenience. This is your opportunity to try a famous Wurlitzer instrument in your own home.



Send for Free Book

Illustrates and describes every known musical instrument—more than 3000 articles, many of them shown in full colors. All genuine Wurlitzer instruments—buy direct from Wurlitzer and save money. Special offers on complete outfits. We also give you our Free Trial, Easy Payment Plan. No obligation.

Send Coupon
Today!

Send this Coupon

The Rudolph Wurlitzer Co., Dept. 1781
117 E. 4th St. Cincinnati 329 S. Wabash Ave. Chicago
120 W. 42nd St. New York 250 Stockton St. San Francisco
Send me your Free Book on musical instruments. Also your Free Trial, Easy Payment Plan. No obligation.

Name _____
Address _____
City _____ State _____
Instrument _____

WURLITZER

Copyright 1925, The Rudolph Wurlitzer Co.

The Shipshape Home

(Continued from page 109)

sion later on. The molding will cover this opening when it is replaced.

For the same reason do not cut the boards too long; they need not be exactly correct in length, as the molding will conceal any irregularities. Endeavor, as far as possible to use boards that will go right across the room in one piece. When shorter pieces must be used, be sure that the joints in two adjacent strips do not come opposite each other.

The boards are fastened by what is known as blind nailing; that is, the nail is driven at an angle through the board, starting just where the tongue joins the edge of the board. The angle should be about 50 degrees from the horizontal.

SIXPENNY wire finishing nails, which are obtainable at any hardware store, may be used for $\frac{1}{2}$ -in. flooring, or a smaller size of cement-coated nails. Regular cut flooring nails should be used, if they can be had, for $\frac{1}{8}$ -in. thick flooring.

The nails should be spaced not farther than 16 in. apart and if the board is at all warped, it is advisable to place the nails closer together, say 12 or 14 in. It is most important not to damage the face of the boards with the hammer. A punch may be used to drive the nails home if any difficulty is experienced.

If the tongue of a board is broken or battered, it should be broken off carefully with the claws of the hammer so that there will be nothing to prevent the next board from closing tightly.

After the floor is well started, so that there is little danger of moving the boards already laid, a piece of waste flooring or a length of two-by-four may be placed on the old floor against the tongue of the piece being laid, and hammered hard enough to force the new board into place. Be careful, however, not to damage the tongue.

On laying the last board, leave a space for expansion, as in the beginning. If this is not done and the floor becomes damp, it may bulge up at some point with such force as to pull the nails. There is then no way of repairing it except to relay the floor.

THE next step is to scrape the wood to make the joints perfectly smooth. This is done with a steel scraper, preferably of a handled type. Scrapers may be made, however, from mowing-machine sections or from old saw blades. Scraping is hard work and perhaps it is advisable to have a professional floor-finisher come in with machines to do the surfacing, if there is one in your locality. Even unscrapped floors, if of oak, will be much better than the average floor found in ordinary new dwellings.

The boards next are sandpapered by placing a sheet of No. 1 $\frac{1}{2}$ sandpaper around a flat-surfaced block. The dust must be removed by sweeping and wiping or with a vacuum cleaner.

If the floor is of clear selected oak, a natural paste wood filler should be applied according to the directions on the container. Cheaper grades, which show

(Continued on page 111)



The balmy warmth of June in your home on winter's coldest day and you can make large fuel savings as well by installing a—

CROWN FUEL SAVER and Smoke Abater

on the feed door of your furnace. This device is attached to your furnace feed door. Mixes red hot oxygen with smoke gases over fire bed. Gets more heat from the fuel.

20% Saving in Fuel

We guarantee it to save that much; often saves more. Easily installed. Entirely automatic.

WRITE TODAY! Full information free. LIVE DISTRIBUTORS WANTED! Profitable, substantial income assured.

C. F. S. CO.
11 N. 10th Street Richmond, Ind.
Sole Canadian Distributor: 33 St. Vincent St., Montreal, Canada.

BIG NOVELTY BARGAIN! 10 Cts.

THROW YOUR VOICE

Into a trunk, under the bed or anywhere. Lots of fun fooling the Teacher, Policeman or Friends. Barrels of Fun.

THE VENTRILO,

a little instrument, fits in the mouth out of sight, used with above for Bird Calls, etc. Sent with full instructions; anyone can use it, NEVER FAILS. Also a 32 PAGE BOOK ON VENTRILOQUISM. Formulas for Secret Writing, 12 Money Making Secrets and the marvelous

NOVELTY X-RAY WONDER

With it you can apparently see the bones in your fingers, lead in pencil, etc; lots of fun with this outfit. Also 10 Big Magic Tricks Free with every order. All the above Novelties by prepaid mail for 10¢

Dept. 305
LARGEST and OLDEST Mail Order House in Connecticut.

VENTRILO COMPANY
Norwalk, Conn.

MOTORCYCLES

LESS THAN HALF COST

Ace, Indian, Cleveland, Harley-Davidson, Henderson Motorcycles and Biscuits, new, used and rebuilt. Rider Agents Wanted. Write for FREE trial offer, agent's free outfit and big bargain booklet. New American Bicycles in different styles and colors. Write for illustrated catalog giving our money saving prices.

AMERICAN MOTOR CYCLE CO.
134 W. Chicago Ave., Dept. 134, Chicago

A 2c Stamp

—will start you on the road to success. See Money Making Opportunities on pages 120 to 150.

I Need Branch Managers

LIGHTNING
Wonderful New Electrolyte charges discharged batteries instantly. Eliminates old sulphuric acid method entirely. Dissolves sulphation. World has waited half a century for this invention. One gallon retails \$10.00, free to agents.

LIGHTNING BATTERY CO., ST. PAUL, MINN.



Electricity
at your finger ends

Know the facts in Electricity. They mean more money and better position for you. Hawkins Guides tell you all you need to know about Electricity. Every important electrical subject covered so you can understand it. Easy to study and apply. A complete, practical working course, in 10 volumes. Books are pocket size; flexible covers. Order a set to-day to get over.

HAWKINS GUIDES

3500 PAGES \$1 A VOLUME
4700 PICTURES \$1 A MONTH

These books tell you all about —

Magnetism — Induction — Experiments — Dynamos — Electric Machinery — Motors — Armatures — Armature Windings — Installing of Dynamos — Electrical Instrument Testing — Practical Management of Dynamos and Motors — Distribution Systems — Wiring — Wiring Diagrams — Sign Flashers — Storage Batteries — Principles of Alternating Currents and Alternators — Alternating Current Motors — Transformers — Converters — Rectifiers — Alternating Current Systems — Circuit Breakers — Measuring Instruments — Switch Boards — Wiring — Power Stations — Installing — Telephone — Telegraph — Wireless — Bells — Lighting — Railways. Also many Modern Practical Applications of Electricity and Ready Reference Index.

SHIPPED TO YOU FREE

Not a cent to pay until you see the books. No obligation to buy unless you are satisfied. Send Coupon now—today—and get this great help library and see if it is not worth \$1.00 to you—pay \$1.00 a month for ten months or return it.

SEND NO MONEY

THEO. AUDEL & CO.
65 W. 23rd St., N.Y.

Please submit for examination Hawkins Electrical Guides (Price \$1 each). Ship at once, prepaid, the 10 numbers. If satisfactory, I agree to send you \$1 within seven days and to further mail you \$1 each month until paid.

Name _____
Address _____
Occupation _____
Employed by _____ I T 34



TOOL CASES for MACHINISTS and TOOL MAKERS

are shown in our new 1926 catalog. Thirty styles and sizes shown. A postal brings the catalog.
H. GERSTNER & SONS
525 Columbia St., Dayton, O.

**Write Today For Our
64 Page Catalog of
RADIO BARGAINS**
RANDOLPH RADIO CORP.
159 N. UNION AV. Dept. 3 CHICAGO, ILL.

RADIO— BARGAINS

FREE RADIO CATALOG & GUIDE of newest ideas, over 100 special hook-ups with illustrations. Shows savings up to 50% on standard radio parts, sets, kits. Be sure to get this thrifty book before you buy. Wonderful? Unusual? You'll say so. Write letter or postal NOW. BARAWIK CO., 102-122 S. Canal St., CHICAGO, U. S. A.



Why Not Solve Your Saw Problems With This Regular Tool?

You will like its sturdy mechanical construction. It will saw wood, fibre, bakelite 1" and metal 3/4" thick. Sold also without motor. We carry a complete line of benchwoodworking machinery. For details write to DELTA SPECIALTY CO. Dept. No. A-106 858 Third St., Milwaukee, Wis.

The Shipshape Home

(Continued from page 110)

sap flaws, require a light golden-oak shade of filler.

A thin solution of burnt umber and turpentine then may be applied to the light places to bring the flooring to an even color. When the filler has dried flat, which takes about half an hour or less, it must be rubbed off across the grain with a cloth, excelsior, or oakum.

Allow the filler to dry hard before applying the first coat of finishing material. This may be floor varnish or white shellac. At least two coats of varnish or two coats of shellac, followed by a coat or two of floor wax, should be applied. The varnish also can be waxed, if desired.

An old, heavy cotton mitt of the padded kind is useful for applying the wax. Spread as even a coat as possible and when the floor is covered, go back to the beginning and start polishing. A floor brush of special design for polishing is easiest to use, although cloths or a dry mitt will serve. If the cloths are wrapped about a heavy flat-iron or other weight, the labor will be lightened. The finishing stroke should be with the lay of the board. Hard rubbing is necessary.

While a good grade of floor varnish gives a harder surface than wax over shellac, it is more difficult to patch any worn places.

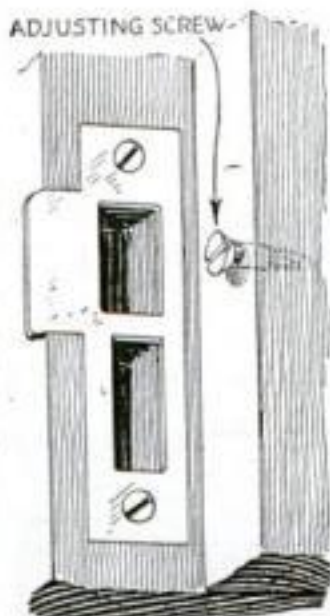
Protecting the surface is what counts in the life of a floor. If you go to the trouble of laying a good floor of this kind, it certainly pays to spend the little time necessary to see that the finish is never worn through.—GEORGE G. McVICKER.

Stopping Doors from Rattling

While rattling doors, which cause annoyance in many houses, can be fixed by the method of moving the strike plate in the door jamb toward the door stop just the right amount, it often happens that the amount of play in a door is so slight that one wishes for a still simpler remedy.

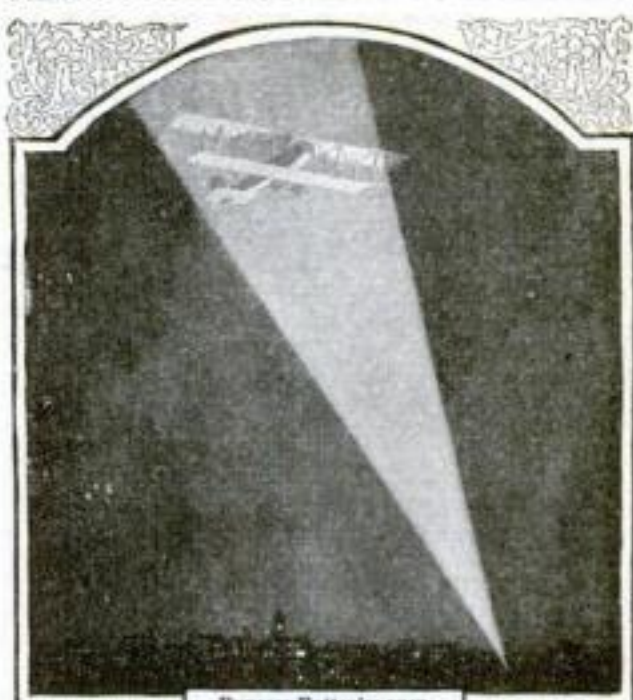
To move the strike plate even a trifle involves chiseling the mortise wider, plugging the old screw holes, and then, if the distance has not been gaged exactly right, filing the plate enough to allow the catch and lock to enter their slots.

The same effect can be obtained, although it is perhaps not so workmanlike a repair, by inserting a common wood screw into the narrow face of the door stop as shown, opposite the lock. A slight turn of the screw will give the correct adjustment to prevent rattling.—E. CROSBY DOUGHTY.



A screw takes up all the "play"

ASK . . ANY . . RADIO . . ENGINEER



Burgess Batteries operate the receiving sets of radio-equipped mail planes

An every-night adventure of Burgess Radio Batteries

ONE of the reasons why you should always buy Burgess Radio Batteries is that the batteries used by air-mail pilots—battleships—explorers—and the majority of recognized radio engineers—are evolved in the Burgess Laboratories and manufactured in the Burgess factory.

These batteries are identical with the batteries sold by your dealer and thousands of other good dealers everywhere.

BURGESS BATTERY COMPANY

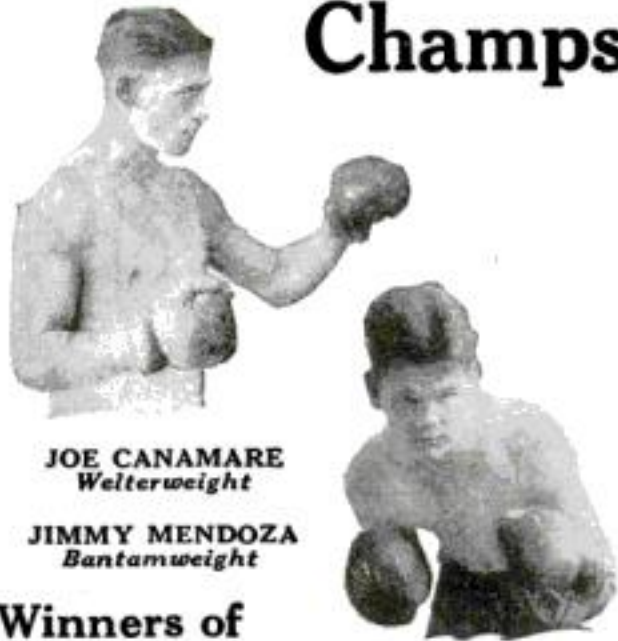
GENERAL SALES OFFICE: CHICAGO

Canadian Factories and Offices:
Niagara Falls and Winnipeg



**BURGESS
RADIO
BATTERIES**

Here Are Two of My Champs



JOE CANAMARE
Welterweight

JIMMY MENDOZA
Bantamweight

Winners of First Championship Contest Selected and Trained by JIMMY DeFOREST World's Greatest Trainer

Here are two of my Champs! How would you like to be one of them? They were selected from the thousands who have completed the JIMMY DeFOREST Boxing Course by Mail. I brought them to my Long Branch, N. J., Camp at my own expense where I finished off in person their training for the ring. Now they have tasted some of the glory of a New York City bout. I will select another lot of Champs in six months. Will you be one of them?

You May Be a Champion

You have as much chance as the next fellow—and it does not make any difference whether you've ever had a Boxing Glove on or not. Most of my boys were the rawest novices when they enrolled for my Complete Course by Mail. Now many of them are finished Boxers earning real money in the ring and some of them are actual contenders for championship titles!

I Will Make You a Skilled Boxer In 20 Weeks

I start you at the very beginning. I teach you step by step every blow, every attack, every defense, every trick and every bit of ring strategy that I taught Jack Dempsey, Firpo, Joe Gans, Pal Moore and a host of other champions and great contenders whom I have trained. Everything I know about Boxing has been set down in one complete Course, that you can master just as thousands of others have done, without leaving your home or interfering with your work.

Box for Health and Wealth

Boxing is acknowledged to be the greatest of all body conditioners. It develops Muscle, Alertness, Poise, Self-Confidence; enables you to protect yourself and keeps you in the "Pink of Condition." Many prominent men and leaders in all walks of life Box regularly to keep themselves fit.

If you become a skilled boxer you can make more money, enjoy more luxuries and freedom than you can by following any other occupation. Fortunes are being made in the ring by lads who formerly could hardly make a decent living. This is the GOLDEN AGE OF BOXING!

This Wonder Book Will Open Your Eyes

Read "The Golden Age of Boxing" if you want to enjoy the most fascinating book of its kind ever written. It contains numerous photos of World's Champions and actual ring battles. It explains in detail how I teach Boxing so successfully by mail. It shows some of the newly devised picture charts I use in my Instructions. It contains a complete outline of my Course week by week, scenes at my well-known camp, photos of some of the lads I have trained by Mail. You'll prize this wonder book. Don't fail to read it. It may change your whole life from drudgery and obscurity to Prominence and Wealth. Send 10c to cover cost of mailing and I'll send you a copy at once. This is YOUR OPPORTUNITY. Mail the Coupon TODAY!

-----CLIP AND MAIL TODAY-----

JIMMY DeFOREST BOXING COURSE
347 Madison Avenue, Box 769, New York City

Gentlemen—

Enclosed find ten cents, for which please send me your book, "The Golden Age of Boxing," without obligation on my part.

(Print Plainly)

Name.....

Street.....

City..... State.....

Better Shop Methods

(Continued from page 76)

Old Bill Says—

KEEP objects from under the toolpost washer; they may cause trouble when you are turning a piece of work within close limits.

If the belt is slack on your lathe or on any other machine, have it taken up.

Some workmen never seem to have the slightest notion of what it costs to run a machine shop. They must think the tools can be bought at a 10-cent store.

The first step in setting up a job is to think out the easiest and quickest way to do it.

A drill press table full of holes or a lathe faceplate cut up are unsightly and the badge of poor workmanship; both can be avoided with a little care.

Every job or piece of work you do is a personal advertisement, and it is up to you whether it is a good or a bad advertisement.

When a drill squeaks in the hole, it is often a sign that the side clearance has been worn away. Trying to force the drill in this condition may result in breaking it.

Carbon tool steel is often superior to high speed steel for putting a good finish on work.

If you remove the center from the headstock of your lathe for any reason, always plug the hole with a piece of clean waste or a rag to keep out the dirt.

A flat drill will drill certain hard, tough materials easier and faster than a twist drill.

Burnishing Broach Gives High Polish to Brass Bushings



BRASS bushings and babbitted bearings may be sized accurately and given a high polish by using a broach made as illustrated rather than by reaming. The tool is used in an arbor press and simply is forced through the work. It will do faster work than a reamer, and on soft metals will leave a finish beyond compare. It is made of tool steel, hardened and highly polished. The first tooth should be ground .015 in. under size and the remaining teeth should taper up to the finish size on the last three teeth.—H. L. WHEELER.

Squab Book FREE

Printed in COLORS. Enlarged. Much News. Squabs are raised in one month, they sell for high prices. Greatest market for 20 years. Make money breeding them. We ship everywhere on three months' trial our famous breeding stock. All pigeon supplies. Established 25 years. For prices and full particulars see our beautiful free book, "How to Make Money with Squabs," with pigeons in colors. Write for it today. PLYMOUTH ROCK SQUAB CO. 616 H St., Melrose Highlands, Mass.

Class Rings and Pins

Largest Catalog Issued—FREE
Samples loaned class officers. Prices \$2.20 to \$8.00 each. No order for class, society or club emblems too large or too small. Special designs made on request.

METAL ARTS CO., Inc., 7706 South Ave., Rochester, N. Y.

"LIGHTING FIXTURES"

Ready to hang. Direct from the manufacturer. Completely wired, including glassware. Send for New Catalogue No. 27 (Just reduced prices) Special proposition to Dealers ERIE FIXTURE SUPPLY CO. Desk A. Erie, Pa.

BUCHSTEIN'S FIBRE LIMB

is soothing to your stump—strong, cool; neat, light. Easy payments. Braces For all deformities. Guaranteed 5 Years. Send for Catalog Today. P. BUCHSTEIN CO., 610-3rd Ave., So., Minneapolis, Minn.

ZIP-ZIP

THOUSANDS of boys are made happy with this wonderful Zip-Zip shooter, something every boy wants and never gets tired of. Zip-Zip shooter is scientifically and practically made; boys, if you like hunting and outdoor sports, get a Zip-Zip shooter with plenty of pep and force and learn that quick and sure aim. If your dealer happens not to have them, order from us. Zip-Zip shooter complete \$5.00 or \$3.00 for \$1.00; send stamps, coin or money order.

AUTOMATIC RUBBER CO., Dept. 22, COLUMBIA, S. C.

MOVIES IN YOUR HOME

Practical Movie Machines in many wonderful models, some as low as \$3.75 and use same size film as big theatres. Fine films at lowest prices with a film exchange service. Many biblical films. Write for free illustrated catalog. PARAMOUNT MFG. CO. Dept. P58, 120 High St., Boston, Mass.

AGENTS 500% PROFIT GENUINE GOLD LEAF LETTERS

Guaranteed to never tarnish. Anyone can put them on stores and office windows. Enormous demand, large profits. Paul Clark says: smallest day \$28.70. R. L. Reel made \$920 in two months. Write today for free sample and liberal offer to general agents. METALLIC LETTER CO., 431A N. Clark Street, Chicago

CLASS 25¢ PINS

BUY DIRECT FROM THE MAKER CATALOG FREE
Either pin shown made with any 3 letters and 2 figures 1 or 2 colors enamel, Silver plate 25¢ ea. \$2.50 doz. Sterling silver, 40¢ ea. \$4.00 doz. BASTIAN BROS. CO. 631 Bastian Bldg., Rochester, N. Y.

Give the Boy a Real PRINTING PRESS!

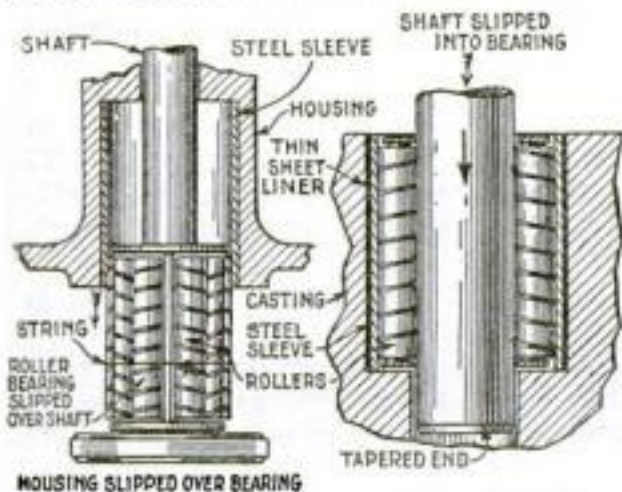
Turn His Ingenuity Into USEFUL CHANNELS
Every boy wants one. Aids grammar, spelling, etc. Education and instruction with wholesome fun. Develops boy's business ability. Complete outfit, \$8.85 up. Adult sizes also. Easy with rules sent. Write for catalog prices, outfits. EXCELSIOR THE PRESS CO., H-33, Meriden, Conn.

Better Shop Methods

Tricks that Are a Help in Repairing Roller Bearings

ASSEMBLING roller bearings of the spiral type usually can be accomplished quickly if advantage is taken of several little kinks that simplify the work.

Before slipping a housing over a bearing, the rollers open up and will not enter the bore. There is no room to place a shield or tin ring around them, but it is necessary only to tie them tightly to the shaft with one turn of ordinary string. This will hold them until the housing has been drawn over them and then the soft



String used to hold rollers together (at left) and liner for taking up play (at right)

string will tear without interfering with the proper functioning of the bearing.

To slip a shaft into a roller nest, there must be a taper on its entering edge. If the shaft end is not tapered, break down the corner with a file.

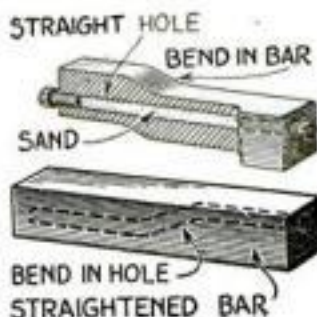
The replacement of an auto bearing is often costly. Roller bearings of the type illustrated usually are used with a split steel sleeve and the wear may be on the inner surface of this sleeve or on the surface of the shaft itself. In either case, the total amount of wear should be determined. If it is desired to save the expense of a new bearing, take up the play by inserting a thin sheet metal strip behind the steel sleeve, as shown. This steel shim stock can be obtained in any width and thickness.

When deciding the thickness of shim stock necessary, make allowance for a few thousandths play. The writer has reshimmed bearings of this type as often as three times. Thin brass also is suitable for shim stock, but in no case use paper.—J. V. R.

Drilling a Bent Hole

IN THE experimental department of a large plant in Philadelphia, the hydraulic engineer required a $\frac{1}{4}$ -in. hole drilled in a piece of copper, as in the lower view. This was accomplished by first making a templet and bending the copper, as shown in the upper view.

The hole was drilled, tapped at each end for a plug, and filled with sand. After that the bar was reheated and straightened.—V. K.



Isn't it worth it?

IN THE PAST twenty years, Fatima has been more widely imitated probably, than any other cigarette—yet today it is as distinctive as ever, in richness of taste, in mildness, in delicacy of aroma. A few cents more, yes—but you get the *real thing*. That's the difference



WHAT A WHOLE OF A DIFFERENCE JUST A FEW CENTS MAKE

LIGGETT & MYERS TOBACCO CO.

**1926 CATALOG
JUST OUT!
SEND FOR YOUR COPY
RANDOLPH RADIO CORP.
159 N. UNION AV. Dept. 3 CHICAGO, ILL.**

HAVE YOU AN INVENTION?

If so the WORLD PROGRESS will send you upon request sample copy Free containing *Suggestions to Inventors* as to Inventions Needed. We invite manufacturers to address us regarding inventions they want. Subscription for one year 60 cents.
WORLD PROGRESS PUB. CO., INC.
Room 202 Victor Bldg. Washington, D. C.



FLY

Young men learn aviation. Build this classy plane and learn to construct and operate aircraft. Use your motorcycle engine or our "Meteor" 20 h.p. motor. We furnish parts very reasonable to build this wonderful little "Meteor" plane, the World's first successful LIGHT PLANE. Send \$3.60 for complete set of blue prints and parts price list of this latest Model M-T-2.

IRWIN AIRCRAFT CO., 116 O Street, Sacramento, Cal.

SEE —
the big Prize Offer on page 4 of this issue

OWN A TYPEWRITER



\$3 and it's yours
if you clip this now

The ace of writing machines—at a bargain price! A free trial, and easiest monthly payments if you buy! This Underwood No. 5—rebuilt from top to bottom—five-year-guaranteed—removes the last reason for not owning your own machine. Get our proposition with new and valuable Typewriting Manual, free.

FREE! Typewriting Manual, large catalog, and full particulars of free course in touch writing, if you mail this to SHIPMAN-WARD MFG. CO., 2141 Shipman Bldg., Chicago.

Name _____
Address _____

This Lathe in Your Shop

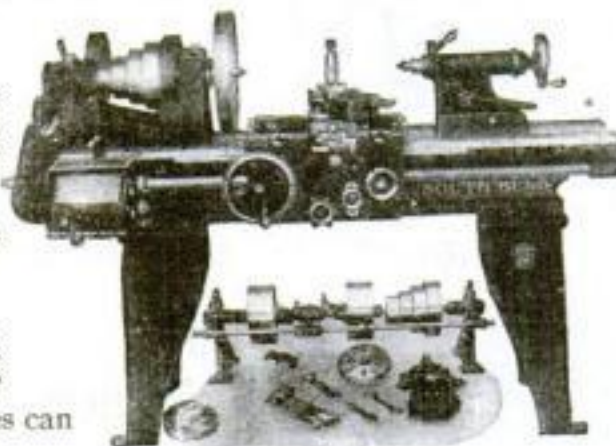
Soon Earns Its Own Cost on Our Easy Payment Plan

We will ship you any size South Bend Lathe on terms of a small payment down and balance in convenient monthly payments. In this way the Lathe saves and earns its own cost.

Note Our Low Net Factory Prices
On South Bend Screw Cutting Standard Change Gear Lathes

9" x 3' Lathe - \$211	15" x 6' Lathe - \$376
11" x 3 1/2' " - 244	16" x 8' " - 438
13" x 5' " - 304	18" x 10' " - 656

Quick Change Gear Lathes in the above sizes can be furnished at a slight increase in price.



FREE CATALOG

shows 96 styles and sizes
Write for it today.

IS

SOUTH BEND LATHE WORKS

618 E. Madison St.

South Bend, Ind.

BLANK CARTRIDGE PISTOL



PRICES
50c.
\$1.00

POST-PAID

Well made and effective; modeled on latest type of Revolver; appearance alone is enough to scare a burglar. When loaded it may be as effective as a real revolver without danger to life. It takes standard .22 Cal. Blank Cartridges obtainable everywhere. Price 50c. Superior quality \$1.00 Postpaid. Blank Cartridges, by express, 50c per 100. Johnson Smith & Co., Dept. 468 Racine, Wis.

13 WEEKS FOR 15 CENTS

The Pathfinder

SHOWS THE WAY THROUGH THE JUNGLE OF EVENTS

You've heard your neighbor praise the old reliable Pathfinder, the wonderful national weekly home magazine that 3 million people read. You can try this unbiased digest of domestic and world affairs for a trial. The Pathfinder is in a class by itself—nothing else to equal it; time-tested, wholesome. Chuck full of the choicest reading—the cream of everything. Science, politics, travel, fun, question box, health, radio etc.; real stories, pictures—instruction, entertainment for all. Send 15c (coin or stamps) for this big paper on trial 13 weeks, or \$1 for full year (52 issues). Pathfinder, Washington, D. C.

Try to take a penny away from this vise

It Can't Be Done!

It takes more than a strong arm and a pair of pliers to take away from a Luther Vise anything it's holding onto!

This husky little work-pal has a bull-dog grip that hangs on like grim death! It won't let go until you are ready to have it let go. Has a wider jaw spread than any other vise of the same size. Extra heavy steel screw, accurately machined. Rugged brass feed screw nut. Strong, heavy pannelled slide bar. All parts carefully machined and fitted together.

Buy this better vise at any good hardware store. Ask for "Luther". Four sizes—1 1/2", 2", 2 1/2", and 3" jaw spread.

Write for free copy of interesting booklet: "Tighten Up"

LUTHER GRINDER MFG. COMPANY
Dept. A, Milwaukee, Wis.

Also manufacturers of high quality Luther tool Grinders.

Luther
QUALITY-BUILT VISES



Musical Popularity

Ability to play a musical instrument always wins popularity. But that is only one of many advantages that come to those who play Hohner Harmonicas.

Hohner Harmonicas win popularity, admiration and friendship. They stimulate interest in good music, develop a sense of accuracy and rythm, lay the foundation for musical education and supply clean, wholesome entertainment for the player and his audience as well.

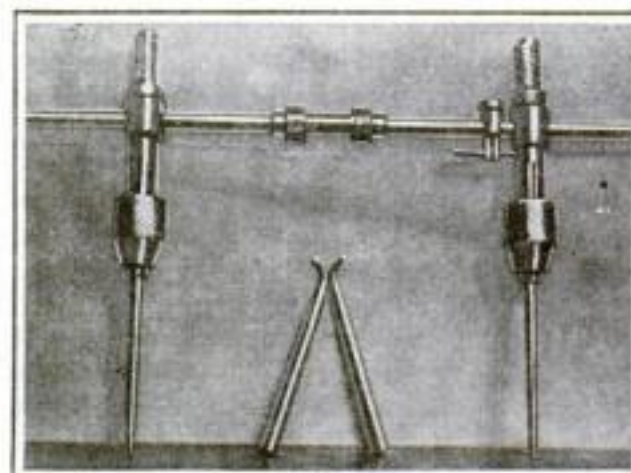
Anyone can learn to play a Hohner Harmonica with the aid of the Free Instruction Book. Ask your dealer for one today; if he is out of copies write M. Hohner, Inc., Dept. 182, 114 East 16th Street, New York City.

"That Musical Pal of Mine"

HOHNER
HARMONICAS

Better Shop Methods

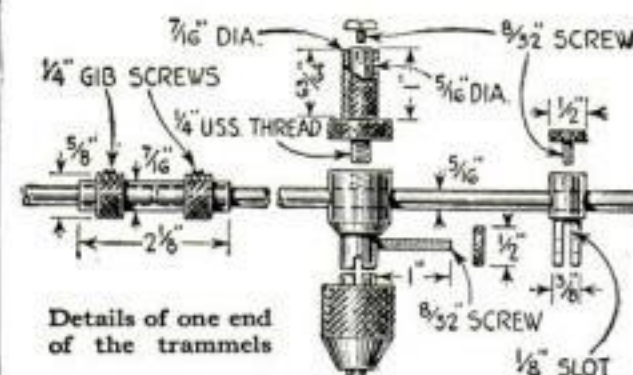
Two Cheap Tap Wrenches Used in Making Trammel Points



TWO tap wrenches bought for 25 cents each were used in making the machinist's trammels illustrated. The wrenches are clamped to the beam, which is flattened on top, by means of knurled screws.

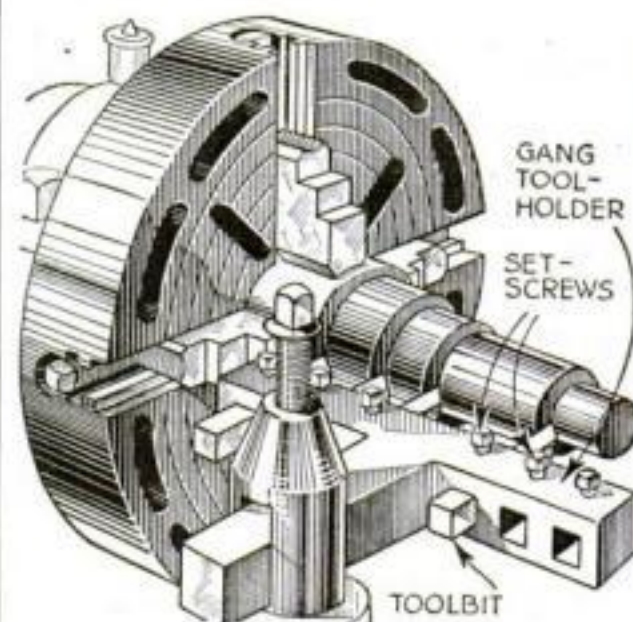
One point has an auxiliary screw for fine adjustments.

A swivel handle at the top of each tram is an advantage, as it enables the trams to be swung around more conveniently. The points and caliper legs can be made to suit individual needs.—D. T.



Gang Tool-Holder for Facing Shoulders on a Lathe

FACING several shoulders on repetition work can be done at the same time with a gang tool-holder such as is illustrated. This effects a saving of time and assures that successive pieces will be duplicates.



Several tools may be held in this holder for facing shoulders on duplicate pieces

The tool-holder is made of machine steel, and high-speed steel bits are held in the slots with setscrews.—G. A. L.

To make a cold radiator HOT



AIRID Air Valves make cold radiators hot. Attach easily to any steam radiator without tools—need no adjusting—never leak—make no noise. Sold at heating and plumbing stores. Only \$1.60.

AIRID AIR VALVES make cold radiators HOT

AMERICAN RADIATOR COMPANY

1813 Elmwood Ave., Buffalo, N. Y.

Send me a trial Airid (one only). (Guaranteed 5 years.) (This will be mailed C. O. D., or enclose check or money order for \$1.60.)

Name

Address

Make Your Roofs Last a Lifetime!

Positively that! The wonderful Seal-Tite method renews, preserves, and makes your old, worn-out roofs watertight. One application lasts 10 years. Write today for this great money-saving roofing offer.

NO Money Asked

We send you everything you need to stop all roof leaks without asking you to send a single penny. No C.O.D. No notes. Pay four months later if our material proves to be exactly as represented.

Write! Don't put off another day finding out all about this wonderful way of solving all your roof problems. We'll make you an offer so liberal, so clear, so surprisingly unprecedented that you simply MUST take advantage of it at once. Don't wait for rain to remind you that your roof leaks. Write TODAY!

Established 1903
Monarch Paint Co. Dept. 13-61 Cleveland, O.



Ⓢ This seal on a radio or tool advertisement signifies the approval of the INSTITUTE OF STANDARDS. See page 6.

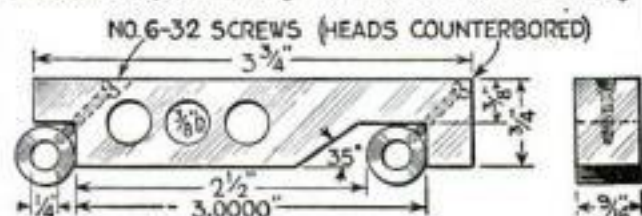
Better Shop Methods

How to Avoid Failure in Making a Sine Bar

FROM the standpoint of the machinist or toolmaker who has to make a sine bar, the design illustrated below has the advantage that there is no danger of grinding and lapping the center distance under size, which would entail scrapping the work.

If it should be ground or lapped under the finished size, the button-resting surface opposite the 35-degree angle is ground or lapped a sufficient amount to correct the error. The same means may be used to correct the bar if at any time it should "go out" because of the distortion of the steel. This cannot be done with an ordinary sine bar.

The buttons may be flush with the sides or left projecting at one side, as desired. When flush with the sides, they do not permit as great an angle to be measured, but they will serve all ordinary



Details of a sine bar, which may be made larger or smaller to meet special conditions

purposes, as the bar may be used with either side to the angle plate.

The button distance may be increased if a larger bar is required, but the 3-in. size is handy for small work. The holes for the screws that hold the buttons are at an angle of 45 degrees. The plugs and bar should be made of a good grade of tool steel, hardened, ground, and lapped all over with the most precise accuracy.—E.T.W.

Wire Clips for Lamp Cords or Air-Hose Lines

PORTABLE lamp cords, air hose, and other flexible lines, such as those carrying coolants to machine cutters, often are fastened temporarily in place with bits of wire or pieces of cord, although the practice admittedly is not workmanlike. It is much better to use clips or hangers.

By bending 1/8-in. spring steel wire as shown, a type of clip may be made that can be attached to all kinds of supports and put to many different uses. As any scraps of steel wire can be used, a set of these clips need not cost a cent.—GEORGE A. LUERS.



He had the right idea

Other fellows had left him in the social background. Girls avoided him. He was missing all the modern fun because he had "nothing to offer to help others have a good time." And he knew it. Then one day he read an advertisement. It held out a promise of popularity if he learned to play a

BUESCHER SAXOPHONE

He knew that was the right idea. He had known it for a long time, but he thought he was musically dumb. "Still, the ad said it was easy." He mailed the coupon, and later sent for a Saxophone for 6 days free trial. Before the end of that period he was playing easy tunes. That was three months ago, and today he's the sheik of his set. He's making nice side-money too playing with a local dance orchestra.

You Can Do It Too! If You Try

Anyone who can whistle a tune can master it quickly. 3 lessons free with each new instrument teach scales in an hour and within a week start you playing popular tunes. From then on its great fun learning, and even though you're only interested for pleasure now, you can in 90 days, if you wish, join a band or orchestra.

Six Days Free Trial - Easy Terms

You take no risk when you order a Buescher for yourself or for a gift. We will send you any instrument you choose, Saxophone, Cornet, Trombone, Trumpet, on six days free trial. This places you under no obligation. If you like the instrument and decide to keep it, pay a little each month. Get the details of this wonderful plan. Clip the coupon below. Send it for the free literature. Send it today. Now.

BUESCHER BAND INSTRUMENT CO.
Everything in Band and Orchestra Instruments
1357 Buescher Block Elkhart, Indiana



This 64 page book tells about the various models with pictures of professionals using them. Send for copy of this wonderful

free SAXOPHONE BOOK

Clip the Coupon NOW!

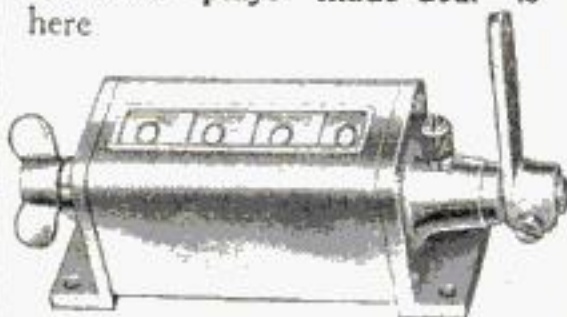
Buescher Band Instrument Co.
1357 Buescher Block, Elkhart, Indiana.
I am interested in instrument checked below.
Saxophone ☐ Cornet ☐ Trombone ☐ Trumpet ☐
(Mention any other instrument interested in)
Name
Street Address
Town State

Machines Win or Lose—on a Dial

Invention, designing, machine development:—all lead up to the record on a COUNTER. *What production?*

On the dial of the Counter the game goes on. Gains in production—good moves mechanically. Losses due to mistakes in mechanism or operating-method.

Your new machine may beat all, *potentially*. But where you see the winning score; where you see what "plays" made *Goal*—is here



—on the dial of your

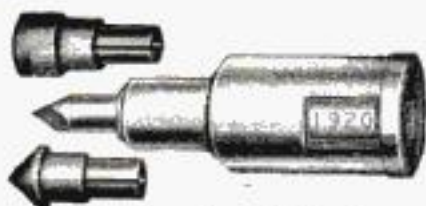
Veeder COUNTER

The large Re-Set Revolution Counter above records the output of any machine where a shaft-revolution indicates an operation.

Sets back to zero from any figure by turning knob once round. Supplied with from four to ten figure-wheels, as required. Price with four figure-wheels, as illustrated, \$10.00 subject to discount. *Cut less than one-half size.* Set-Back Rotary Ratchet Counter, to record reciprocating movements as to presses, \$11.50 (list.)

Speed Counter

Here's the handiest instrument for finding revolutions-per-minute of a shaft or flywheel. You hold the tip of the counter against end of revolving shaft; press lightly when the second hand of your watch comes to 0; release pressure when minute is up. A spring clutch controls the recording mechanism.



(Cut less than 1/2 size)

For keeping motors, generators and machines running at *efficient speeds*. Price, with two rubber tips, (as illustrated) \$3.50.

FREE: The foremost booklet on Counters, to help in your development work.

The Veeder Mfg. Co.
44 Sargeant St., Hartford, Conn.

Better Shop Methods

How to Make a Press for Relining Brake Bands

By Frank N. Coakley

FOR the garage man or other mechanic who has a great many brake band renewal jobs, the press illustrated is well worth making. No patterns or castings are required. All the parts are especially heavy so that the press will stand hard usage and will serve for other purposes. The maker can use his own judgment in the matter of sizes, however, and be guided by his own requirements and the scrap material available in the shop junk heap and elsewhere.

The main frame is a length of 10-in. I-beam. It either is set in the floor in concrete or fastened to the end of a bench. To the top of the beam a 1/2-in. plate 2 in. long is riveted. This plate supports the 3 1/2 by 7 in. angles, that act as the side guides and the fulcrum plates for the top lever. This lever is 2 ft. 6 in. long between the centers of the pinholes.

The ram end is drilled for a 1/8-in. pin. The rod end is provided with a 1/2-in. hole.

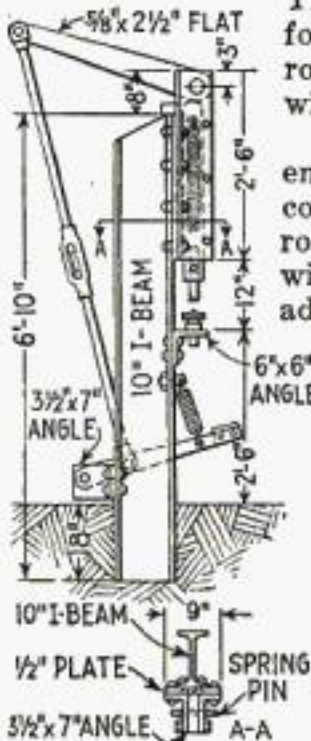
Regular brake-rod ends can be used as connections for the pull rod, which is provided with a turnbuckle for adjustment. The pedal is built from a piece of 5/8 by 2 1/2 in. flat steel. A small piece of angle is riveted to the end to provide a foot rest. A piece of 3 1/2 by 7 in. angle is riveted to the beam to act as a fulcrum point for the foot lever. A spring is provided as shown to act as a pull back for both the top and the bottom levers.

A shelf made from a piece of 6 by 6 in. angle is riveted to the beam 2 ft. 6 in. from the floor. A hole is provided through which the riveting block pin projects so that it will be kept central.

The ram of the slide is made from a piece of 2 by 3 in. flat steel. A hole is drilled in the bottom to hold the riveting punch, which is held in place by a setscrew. The top end of the ram is rounded to allow the top lever to slide on it easily.

A strip of brass is placed between the ram and the beam. A piece 2 in. square is bolted between the two side angles and acts as a front plate. A slotted hole is provided in the lower end of these angles to allow a pin in the ram to slide up and down. To this pin two springs are fastened to act as a pull back for the ram.

GLASS may be filed with comparative ease if the work is done under water. This insures that the file will not become dull so rapidly.



Side view of press and section through ram

FREE! To Each Purchaser of a **WORLD 6V. Auto or Radio BATTERY**

12-Cell—24-Volt Storage 'B' Battery

Positively given free with each purchase of a WORLD "A" Storage Battery. You must send this ad with your order. WORLD Batteries are famous for their guaranteed quality and service. Backed by years of successful manufacture and thousands of satisfied users. Equipped with Solid Rubber Case, an insurance against acid and leakage. You save 10 per cent and get a

2-Year Guarantee

Bond in Writing "Tell their friends." That's our best proof of performance. Send your order to today.

Solid Rubber Case Radio Batteries

6-Volt, 100-Amperes	\$11.25
6-Volt, 120-Amperes	\$12.25
6-Volt, 140-Amperes	\$14.00

Solid Rubber Case Auto Batteries

6-Volt, 11-Plate	\$11.25
6-Volt, 12-Plate	\$12.25
12-Volt, 7-Plate	\$16.00

Send No Money Just state battery wanted and we will ship day order is received, by Express C. O. D. subject to your examination on arrival. **FREE!** "A" Battery included. **Extra Offer:** 5 per cent discount for cash in full with order. Buy now and get a guaranteed battery at 50 per cent saving to you.

WORLD BATTERY COMPANY
1219 So. Wabash Ave., Dept. 7 CHICAGO, ILL.

World STORAGE BATTERIES

Set your Radio Dial at 210 meters for the new 1000 watt World Storage Battery Station, WSDU, Chicago. Watch for announcements.

RDKA—WEAF—WGN—WJS—KHJ—KGO—KFAF—WJY—KOB

Stop Using a Truss

STUART'S PLAPAO-PADS are different from the truss, being mechanico-chemical applicators made self-adhesive purposely to hold the distended muscles securely in place. No straps, buckles or spring attached—cannot slip, so cannot chafe or press against the pubic bone. Thousands have successfully treated themselves at home without hindrance from work—most obstinate cases conquered. Soft as velvet—easy to apply—**inexpensive**. Awarded Gold Medal and Grand Prix. Process of recovery is natural, so afterwards no further use for trusses. We prove it by sending Trial of Plapao absolutely **FREE**. Write name on Coupon and send **TODAY**. **FREE** Plapao Co., 790 Stuart Bldg., St. Louis, Mo.

Name.....
Address.....
Return mail will bring Free Trial Plapao

SAVE MONEY

RADIO GUIDE FREE

Hot off the press—latest Radio Catalog & Guide brimful of new ideas, over 100 special hook-ups with information—all free. Shows savings as high as 50% on sets and supplies. Be sure to get this thrifty illustrated book before you buy. It means money in your pocket. Standard guaranteed goods. Write letter or postal now. Also please include name of radio friend.

BARAWIK CO., 102-1225, Canal St., Chicago, U.S.A.

LATEST WHOLESALE RADIO CATALOG

FREE

Simply send name **TODAY** for big 64-page book explaining liberal proposition paying agents \$60 to \$100 a week, and how to get latest radio goods at Wholesale. Live dealers and agents wanted. **STANDARD RADIO CO., 104 Walnut St., Kansas City, Mo.**

BARGAINS!

SAVE 1/3 TO 1/2

WRITE FOR CATALOG

RANDOLPH RADIO CORP.
159 N. UNION AV. Dept. 3 CHICAGO, ILL.

Better Shop Methods

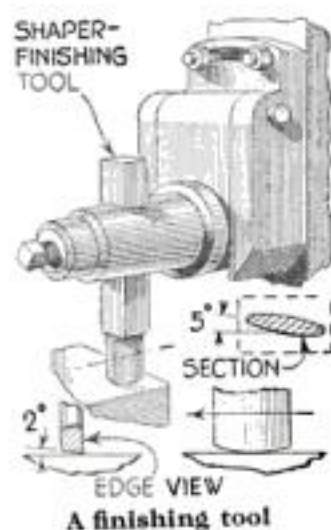
Clamping Fixture for Filing Small Pieces at an Angle

FILING an angle on a large number of small pieces often may be made easier by the construction of an auxiliary clamp or fixture of the type illustrated. This is a piece of flat steel bent to suit the work and held in the bench vise. The bend should be such that the two sides of the fixture will be approximately parallel when the vise jaws are closed upon them.



Elliptical Shaper Tool Insures a Smooth, Shearing Cut

SQUARE-NOSED tools tend to dig in when finishing tool steel, or alloy steel in the shaper or planer, which makes it difficult to produce a smooth surface. The tool shown, if used for this purpose, will insure a good finish.



It is forged in one piece of the best grade of carbon tool steel, high speed steel not being recommended, and is tempered in the usual way.

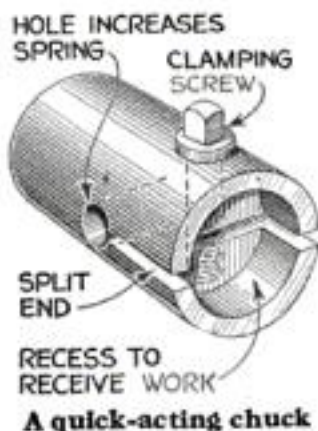
In section it is slightly elliptical, and is ground at an angle of about

5 deg. so that the cutting point is about midway of the blade. This gives a shearing action.

The tool is to be used only for finishing with a light cut and a fine feed. Use oil for best results.—H. L. W.

Chuck for Round Blanks

GEAR blanks, or similar work, may be handled very rapidly and accurately for facing or reaming in the chuck illustrated, which is gripped in the usual four-jawed chuck. The spring hole is drilled, the end split, and the clamping screw is put in before the the hole for the blank stock is bored. The clamping screw is tightened a little before boring so that the chuck will release the work readily when the screw is loosened. This type of chuck may be used again if it is trued up carefully at the first setting, or it may be bored out when necessary to take a blank of larger size.—S. W. BROWN.



A quick-acting chuck

Klein Pliers Tackle Any Job!

FOR radio and auto Klein Pliers are indispensable, of course. But that's not all! Klein's are plucky pliers that tackle any job with a keen bite and a stubborn grip. Handy fellows in every tool box! Pick up a pair at your hardware store.



Mathias **KLEIN** & Sons
Established 1857 Chicago, U.S.A.

DISTANCE

THE OBEDIENT SLAVE TO YOUR DESIRES

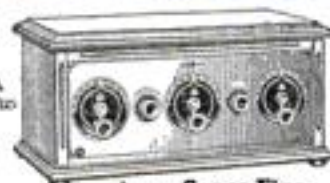


APEX mastery over the most advanced radio engineering principles makes distance the obedient slave of your desires and places at your instant command the whole continent of radio enjoyment.

The infinite care and skill employed in perfecting the mechanical construction of APEX Radio Apparatus is radiantly reflected in the rich beauty of design, harmony of proportion and elegance of finish that stamp all APEX sets with an unmistakable mark of master craftsmanship.

Only a dependable merchant is given the APEX dealer franchise. Your APEX dealer will gladly make a personal demonstration of APEX Quality Radio Apparatus.

APEX ELECTRIC MFG. CO.
1410 W. 59th St., Dept. 103
CHICAGO



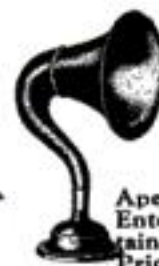
Apex Super Five
Price \$80 without accessories



Apex Utility
Radio Table
Price \$75



Apex Console
Entertainer—Price \$27.50



Apex
Entertainer
Price
\$22.50



Apex
Baby Grand Con-
sole—Price \$225



Apex De Luxe
Price \$135

Prices West of Rockies slightly higher—Canadian prices approximately 40% higher



SHOW CARD LETTERING *Learn at Home*

HERE is the very course you need if you want to get a good paying position as a Show Card Letterer or Sign Letterer, or have a business of your own. This course is complete and practical and especially arranged to meet the needs of the student who studies at home. It was written by E. L. Koller, Principal of the School of Art of the International Correspondence Schools, member of the American Federation of Arts, and The National Society of Craftsmen.

Mr. Koller has had twenty years' teaching experience, and his success in helping other men and women is an indication of what he can do for you.

H. L. Wood, a clerk, made more than \$700 "on the side" before he had completed his course and also won \$125 in prizes. Harry William Lord writes that he has more than doubled his salary as a result of studying this I. C. S. course in spare time. William Whitman, a former wagon builder, now has a sign painting business of his own and is earning nearly three times as much as he did before enrolling with the International Correspondence Schools.

There is no doubt that Show Card Lettering and Sign Lettering offer a real opportunity to ambitious men and women. Just mark and mail the coupon and we'll gladly send you a booklet telling all about the I. C. S. course in Show Card Lettering, or any other subject in which you are interested.

INTERNATIONAL CORRESPONDENCE SCHOOLS

Box 7677-D, Scranton, Penna.

The oldest and largest correspondence schools in the world

Without cost or obligation on my part, please tell me how I can qualify for the position or in the subject before which I have marked an X:

☐ SHOW CARD LETTERING

- | | |
|---|---|
| <input type="checkbox"/> Business Management | <input type="checkbox"/> Salesmanship |
| <input type="checkbox"/> Industrial Management | <input type="checkbox"/> Advertising |
| <input type="checkbox"/> Personnel Organization | <input type="checkbox"/> Better Letters |
| <input type="checkbox"/> Business Law | <input type="checkbox"/> Stenography and Typing |
| <input type="checkbox"/> Banking and Banking Law | <input type="checkbox"/> Business English |
| <input type="checkbox"/> Accountancy (including C.P.A.) | <input type="checkbox"/> Civil Service |
| <input type="checkbox"/> Nicholson Cost Accounting | <input type="checkbox"/> Railway Mail Clerk |
| <input type="checkbox"/> Bookkeeping | <input type="checkbox"/> Common School Subjects |
| <input type="checkbox"/> Private Secretary | <input type="checkbox"/> High School Subjects |
| <input type="checkbox"/> Spanish | <input type="checkbox"/> Illustrating |

TECHNICAL AND INDUSTRIAL COURSES

- | | |
|---|--|
| <input type="checkbox"/> Electrical Engineering | <input type="checkbox"/> Architect |
| <input type="checkbox"/> Electric Lighting | <input type="checkbox"/> Architects' Blueprints |
| <input type="checkbox"/> Mechanical Engineering | <input type="checkbox"/> Contractor and Builder |
| <input type="checkbox"/> Mechanical Draftsman | <input type="checkbox"/> Architectural Draftsman |
| <input type="checkbox"/> Machine Shop Practice | <input type="checkbox"/> Concrete Builder |
| <input type="checkbox"/> Railroad Positions | <input type="checkbox"/> Structural Engineer |
| <input type="checkbox"/> Gas Engine Operating | <input type="checkbox"/> Chemistry <input type="checkbox"/> Pharmacy |
| <input type="checkbox"/> Civil Engineer | <input type="checkbox"/> Automobile Work |
| <input type="checkbox"/> Surveying and Mapping | <input type="checkbox"/> Airplane Engines |
| <input type="checkbox"/> Metallurgy <input type="checkbox"/> Mining | <input type="checkbox"/> Agriculture and Poultry |
| <input type="checkbox"/> Steam Engineering <input type="checkbox"/> Radio | <input type="checkbox"/> Mathematics |

Name

Street Address

City State



Start a Movie Show

SMALL CAPITAL STARTS YOU
Big opportunity to become independent. No experience needed. We show you how. Our easy payment plan makes it easy to start. We equip you complete. Our machines used and endorsed by government institutions. Write today for free catalog.

ATLAS MOVING PICTURE CO.
520 S. Dearborn St., Dept. 71, Chicago

64 Illustrated Pages of Radio Bargains!

Write for Catalog Today

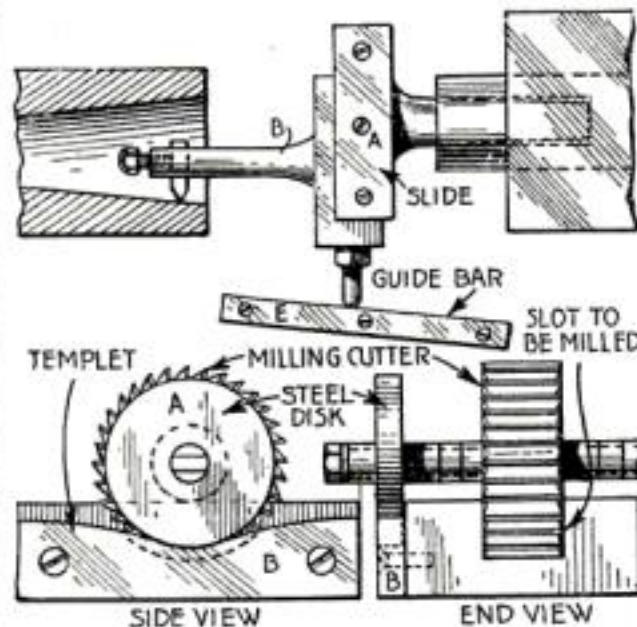
RANDOLPH RADIO CORP.
159 N. UNION AV. Dept. 3 CHICAGO, ILL.

Better Shop Methods

Two Ways of Simplifying Difficult Milling Jobs

ON OCCASIONS when it has been necessary to bore a tapered hole with a milling machine, I have used the method shown in the upper view of the accompanying illustration. The guide bar was set on an angle corresponding with the desired taper and fastened to the milling-machine table in the most convenient manner. An adjustable boring head of a common type without transverse screw adjustment was inserted in the spindle to carry the boring tool.

The head slide was provided with a contact piece to strike against the guide bar at each revolution of the spindle. The work was advanced with the finest



Boring a tapered hole and using a templet in milling a groove of irregular contour

possible feed and the slide, of course, followed the guide bar much the same as a cross slide follows a taper attachment on a lathe. A similar set-up can be used on a drill press when you wish to bore a tapered hole.

Another trick I have used is the method of cutting irregular contours in odd shaped pieces and cams that is illustrated in the lower view.

In this instance a groove had to be cut in a steel block. A templet was made to correspond with the desired shape and attached to the piece to act as a profiling guide. A steel disk of suitable diameter was put on the arbor with the mill and so located that it rested on the guide plate when the mill was in a position to make the cut. The templet was held in contact with the disk by manipulating the vertical and table feeds of the machine.—CHARLES KUGLER.

Making Special Nuts

SO MANY uses are found for hexagon stock that it pays even a small shop to keep on hand a few bars of the more common sizes. This stock is especially useful when special hexagon nuts are needed. The only work required is to drill and tap the holes and cut off the nuts, facing them afterward on a thread arbor. This is so much quicker than machining the entire nut that the time saved more than warrants the expense of carrying a few bars of stock.—H. L.



Save \$44.00 on this Beautiful White Enameled Kitchen Cabinet

THIS handsome white-enameled kitchen cabinet would cost \$65 if bought in a store. If you are handy with tools you can make it at home for \$21—or less. A clear saving of \$44.

One feature of this cabinet is a self-contained seat. Another attractive feature is the roomy china closet occupying the middle section of the top of the cabinet.

Besides the china cupboard, the top section contains a flour-bin and a closet for sugar, spices, and coffee. The bottom section has one large cupboard and three drawers, the lower one being a metal-lined bread and cake container. There are two large boards that pull out.

A blueprint with full instructions for making this beautiful cabinet can be secured by sending 25c to

POPULAR SCIENCE MONTHLY,
250 Fourth Avenue, New York

POPULAR SCIENCE MONTHLY
250 Fourth Avenue, New York

Enclosed is 25c for which please send me your blueprint for Kitchen Cabinet including all the latest features—

Name

Address

City

State

The Loud Speaker Sensation..!



Design Patented

The KODEL MICROPHONE LOUD SPEAKER

An exact replica of the transmitting microphone used in broadcasting stations.

The efficient KODEL SOUND UNIT, with an ingenious new snail-shell horn, mounted inside the microphone case, produces a remarkably clear, full-toned volume, with every note as rich and true as when it enters the transmitting microphone in the studio. Non-vibrating tone chamber absolutely eliminates distortion.

\$15 Model incorporates new Kodel, Jr. unit; with large Kodel unit, \$20. **\$15.00**

Radio dealers everywhere have them.

THE KODEL RADIO CORP.
500 E. Pearl St. Cincinnati, O.

Manufacturers of Kodel Radio Receivers and Accessories, and Homcharger Battery Chargers.



WKRC

Owners of Kodel Broadcasting Station WKRC. Send for program

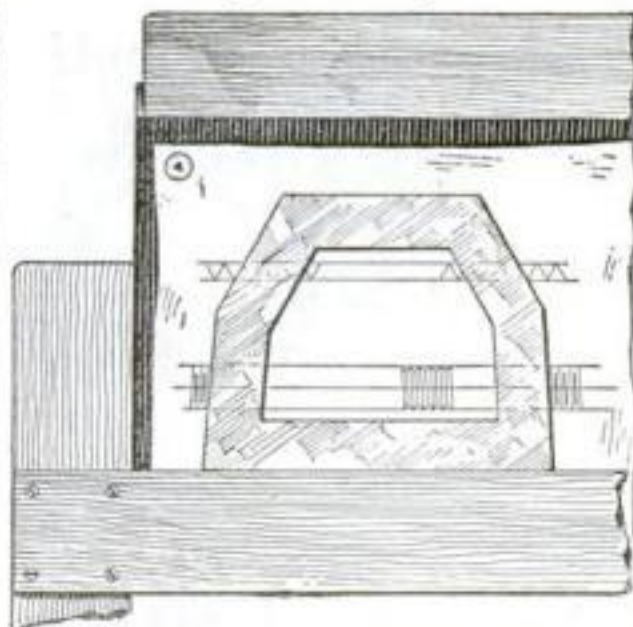
Better Shop Methods

Draftsman's Templet Saves Time in Drawing Threads

DRAWING screw threads, which is a time-consuming detail in the work of every mechanical draftsman, can be expedited by the use of a templet made as shown of celluloid, wood, or hard rubber.

A piece of material 1/16 by 4 by 5 in. makes a templet of a handy size, but the dimensions can be larger or smaller, to suit the individual requirements.

The angle on each side of the upper half of the templet is 30 degrees from the



Threaded parts may be drawn quickly on machine details with this drafting templet

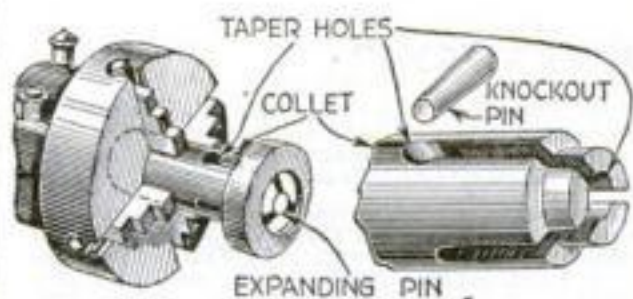
perpendicular and is used in drawing the thread proper. The angle of the sides on the lower half is 4 degrees from the perpendicular and is used to draw lines representing the pitch. The inside and outside angles are the same because often it is convenient to use both at once.

While the angle representing the pitch is not correct for all threads, it is a mean between a standard 1/4-in. and a 1-in. thread and is as accurate as ordinarily is required for routine mechanical detailing.—BOYD R. ALVORD.

Easily Made Expanding Collet

FOR facing small pieces in a lathe, the expanding chuck or collet illustrated below is especially useful.

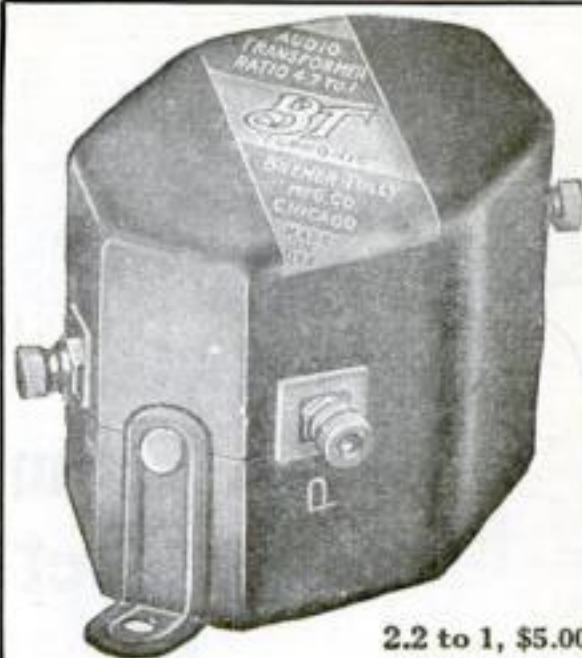
A length of round stock is turned at one end to suit the work to be held, the reduced section being slightly shorter than the thickness of the pieces. A hole



A simple chuck of expansion type for holding small pieces that are to be faced in a lathe

is drilled and reamed in the end of the collet to take a taper pin. Another tapered hole is run into the first hole to take a knockout pin. The end finally is slotted as shown.

In use the work is placed against the shoulder and the taper pin is driven into the end hole.—R. H. KASPER.



2.2 to 1, \$5.00
4.7 to 1, \$5.75

Greater Improvement Than Was Thought Possible

Never has a B-T product met with such instant enthusiasm as greeted the Euphonic Audio Transformer. Many believed such improvement impossible but a single hearing left no room for doubt.

B-T research has succeeded in creating a transformer with an iron core placed to better advantage and coil with 50% more turns than usually employed.

It costs more to make, but after you hear Euphonic you'll agree it's worth while.

READ

What J. E. Martin, Kansas City, says of the B-T "Counterphase"

The Counterpiece is in every particular by far the most efficient receiving set that I have owned or heard in operation.

One stage of audio is quite sufficient for ample loud speaker reception in five rooms of all class B stations in the U. S., and many class A.

And this from Cincinnati.

Summarizing tests on Counterphase Set I can safely say it has more volume, greater selectivity, greater sensitivity, and produces higher quality of reproduction than any receiving set I have ever heard.

From Ft. Wayne, Ind., Oct. 16, 1925

I consider "Better Tuning" one of the best and most sensible booklets ever issued by any radio set manufacturer.

Circulars for the asking.

"Better Tuning."

80 pages, 10c.



BREMER-TULLY MFG. CO.
532 So. Canal Street, Chicago

Clear-Tone TO Clear Your Skin

Your skin can be quickly cleared of Pimples, Blackheads, Acne Eruptions on the face or body, Barbers Itch and Eczema, Enlarged Pores, Oily or Shiny Skin. CLEAR-TONE has been Tried, Tested and Proven its merits in over 100,000 test cases.

FREE WRITE TODAY for my FREE Booklet—"A CLEAR-TONE SKIN"—telling how I cured myself after being afflicted for fifteen years.

E. S. GIVENS 153 Chemical Bldg. Kansas City, Mo.

Money Making Opportunities for "Popular Science" Readers

Readers of POPULAR SCIENCE MONTHLY will find scores of opportunities in this section (pages 120 to 150) for making more money.

Rouse Your Bigger and Better Self to Action!

I'll help you prove to the world that you CAN succeed!

ELECTRICITY

- Will Fascinate You!
- Will Thrill You!
- Will Reward You!

HAVING HARD LUCK? Think the world's against you? Are you trying to FIND yourself, so that you may take your rightful place among happy, successful, independent folks?

WHY LEAD AN INFERIOR EXISTENCE? No need to drag through life with little or nothing of this world's goods in return for your hard, earnest labor! The chances are 100 to 1 you've got the right stuff in you! You've simply got to apply it IN THE RIGHT DIRECTION, like successful folks do.

EVERY HONEST, SINCERE, WORTHY, AMBITIOUS FELLOW is entitled to an even break in life. Others are getting theirs! Why not YOU? Right now is the time to solemnly promise yourself to get rid of the jinx that's chasing you through life!

HUNDREDS OF COYNE-TRAINED MEN EARN \$60 TO \$200 A WEEK

ELECTRICITY is a vast field of rich opportunities! It offers clean work, steady employment, BIG PAY to men who are properly trained. It's the ideal

field for regular fellows—HE-MEN—who want to get ahead in life. This is truly the ELECTRICAL AGE and your day of opportunity.

COMPLETE ELECTRICAL TRAINING In 12 Happy Weeks at Coyne

**Send For My Big Free Book
and Special Offer of
2 Extra Courses**

**Surprisingly Large, Handsome and
Complete Electrical Book Costs You
Nothing; Now or Later**

I've just printed a great big, handsome, two-color Electrical Book that I want to send you at once. It is 12x15 in size and contains 161 actual photos of electrical scenes and operations. Tells about dynamos, radios, autos, airplanes, farm lighting and power, etc. Nothing like it. You'll be amazed. ABSOLUTELY FREE. REMEMBER—

SEND COUPON NOW

H. C. LEWIS, President
COYNE ELECTRICAL SCHOOL
1300-10 W. Harrison St.
Dept. 1361 Chicago, Illinois

Dear H. C.—You can just bet I want one of those big, handsome FREE 12x15 books, with 161 actual photographs printed in two colors. Send it quick, before the supply is exhausted. Be sure to tell me all about Special Offer of 2 Big Courses Without Extra Cost.

Name.....
Address.....

I have perfected an unusual course of instruction in Electricity, a course that is absolutely thorough, that is easy to master, that covers every single phase and factor of the subject, that fits men for the BIG electrical jobs—the HIGH-SALARIED thrilling jobs.

COYNE does not teach by correspondence, but by practical, personal training in the wonderfully-equipped COYNE Shops, located in Chicago, the electrical center of the world. At COYNE your training is really PERSONAL and PRACTICAL, on the most MODERN and COMPLETE electrical apparatus, under guidance of thoroughly-qualified instructors. You also visit great industrial organizations and power plants.

Tune in on COYNE Radio Station WGES

COYNE

ELECTRICAL SCHOOL

H. C. LEWIS, President

Established 1899

1300-10 W. Harrison St. Dept. 1361 Chicago

There is no Substitute for Personal Training,
in Great Shops, on COMPLETE Apparatus

Every reader of POPULAR SCIENCE MONTHLY is invited to enter this contest—

\$100 in CASH PRIZES

For the best letter of 150 words or less answering the question—

“What advertisement in the ‘Money-Making Opportunities’ Section interests you most—and why?”

we will pay on February 10th, the following cash prizes:

First Prize	\$50.00
Second Prize	25.00
Third Prize	10.00
Fifteen Prizes	of \$1.00 Each 15.00

First read every advertisement in the Money-Making Opportunities Section on pages 120 to 150. Pick out the one that interests you most and then write a letter—not exceeding 150 words—telling us why you find the advertisement you have selected the most interesting.

Entries for the contest will close on January 1st. The prize winners and their letters will be published in the March issue of POPULAR SCIENCE MONTHLY.

Address your letter to

Contest Editor

MONEY-MAKING OPPORTUNITIES
POPULAR SCIENCE MONTHLY
250 Fourth Ave., New York

From an Idea to the Greatest Man-Building Institution in the World

—And What It Means to Men Who Want to Attain Independence

By J. E. Greenslade

REQUESTS for more than 50,000 salesmen were received by the Employment Service Department of the National Salesmen's Training Association during the past 12 months.

Wholesalers, manufacturers, jobbers and other employers of salesmen all over the North American Continent continually recruit their sales forces from the ranks of N. S. T. A. Members.

Surely this is unquestionable proof of the great demand for salesmen and a great tribute to the Association. And yet, only a little over eighteen years ago this great Institution, headquarters for Scientific Salesmanship, was but an idea. Today, the Association can number its Members in the tens of thousands, all over the English speaking world—and thousands of them have attained financial independence as a result of the training they received with the Association.

It has always been my personal belief that it is better to do one thing WELL than to do several things in a mediocre fashion. For this reason myself and my associates have never attempted to teach other subjects. Salesmanship is a never-ending study—and in over eighteen years the Association has never let up in its search for new ideas.

Not a "One Man" Institute

No one man has been responsible for the N. S. T. A. System of Salesmanship Training. No matter how brainy, or successful one man may be his viewpoints and ideas must necessarily be prejudiced and limited.

Thousands of master minds in selling have contributed to the N. S. T. A. text—and will continue to contribute to it. Many leading sales authorities are ACTIVELY identified with the association at the present time—each man a sales executive with a nationally known company.

Read What They Did

\$12,000 a Year

A. H. Ward, Chicago, left a small pay job. Now he averages \$12,000 a year as a salesman.

\$150 to \$500 a Month

W. P. Clenny of Kansas City, Mo., stepped from a \$150 a month clerkship into a selling job at \$500 a month. One month he made \$850.

\$6500 a Year

M. V. Stephens of Albany, Ky., was making \$25 a week. He took up this training and now makes 5 times that much.

Small Pay to Big Earnings

J. H. Cash of Atlanta, Ga., exchanged his \$75 a month job for one which pays him \$500 a month.

How the N. S. T. A. Originated

Twenty years ago when I was Sales Manager for a nationally known firm that employed hundreds of salesmen, I found that my sales letters and bulletins helped my men to increase their sales. In one year, as a result of weekly letters and bulletins to the man in the field we increased our business 132%. Is it any wonder that I conceived the idea of teaching salesmanship by mail?

With the assistance of a few able friends in the profession, the Association was formally launched in 1907. Today, it is the largest and oldest Institution in the world specializing in Salesmanship Training.

Is it any wonder that our Members make good right from the start when the proved plans, wisdom and experience of hundreds of sales authorities are laid before them?

No institution can guarantee a man success. But the N. S. T. A. can guarantee to give any man the finest training in salesmanship in the world. It can guarantee that no other institution can produce the same evidence of merit or offer as much for the nominal tuition fee.

Furthermore, the N. S. T. A. has an iron-clad MONEY-BACK GUARANTEE as tangible evidence of merit.

EMPLOYERS are invited to write to the Employment Dept. of the N. S. T. A. We can put you in touch with just the men you need. No charge for this service to you or our members. Employers are also cordially invited to request details about the N. S. T. A. Group plan of instruction for entire sales forces. Synopsis and charts sent without obligation.



NATIONAL SALESMEN'S TRAINING ASSOCIATION
WORLD'S OLDEST AND LARGEST *Exclusive* SALES TRAINING INSTITUTION

Dept. A-15

N. S. T. A. Building
Chicago, Ill.



Why Dodge Better Pay?

If thousands have succeeded in a big way as a result of N. S. T. A. Training—most of them, men who had never sold a dime's worth of goods in their lives before enrolling—is there any reason why YOU should not succeed in the greatest of all professions—salesmanship?

No man is more important in business than the salesman. He tops the list because he is the MOTIVE POWER back of any business. And you can quickly and easily learn the secrets that make Master Salesmen. Inside twenty weeks you can start out as a city or traveling salesman—fortified with the knowledge that has enabled thousands of our Members to step from poor pay to big earnings.

This opportunity is before you NOW—backed by a Money-Back Guarantee. Are you going to be a wage slave this time next year when there are thousands of openings waiting for men who KNOW HOW TO SELL.

With My Compliments—An Amazing Book

It will not obligate you to fill in and mail the coupon below. And you owe it to yourself. I want you to get the facts—then decide for yourself. This book, "Modern Salesmanship," will prove a revelation to you. Let me send it to you. You certainly ought to read it if you want to make more money. And who doesn't?

NATIONAL SALESMEN'S TRAINING ASSOCIATION

Dept. A-15
N. S. T. A. Building, Chicago, Ill.



National Salesmen's Training Association,
Dept. A-15, N. S. T. A. Bldg., Chicago, Ill.
Send me FREE your book "Modern Salesmanship,"
and proof that I can become a Master Salesman.

Name.....
Address.....
City..... State.....
Age..... Occupation.....

22 YEARS OF SUCCESS

CHICAGO TECHNICAL COLLEGE

FROM THIS RECOGNIZED COLLEGE OF ENGINEERING

a Home-Study Course in DRAFTING

Everything today is built from drawings made by Draftsmen. Industry calls for 50,000 new men yearly. Draftsmen work hand in hand with the architect, the engineer, the designer, the builder. And thus many men rise from such positions to be heads of great contractors' organizations, directors of railroads, chief engineers—responsible positions commanding very attractive salaries.

FREE TRIAL LESSON

Prove your fitness and liking for one of industry's highest paid professions. We want you to know what Drafting is like . . . how readily you can progress . . . how we train and teach you by mail. So, before you enroll . . . FREE . . . without cost or obligation . . . we send you a trial lesson to study in your own home.



Mr. George Roudanez

DRAFTING HALL OF FAME

Several years ago, Mr. Roudanez—then earning \$25.00 a week—graduated from the Mechanical Department of Chicago Technical College. The College Employment Bureau placed him in his first two positions. And today, he is President and General Manager of the Economy Clamp & Machine Co. His rapid rise he attributes to the sound and thorough training received at Chicago Technical College. What this training has done for him it will do for any man ambitious to increase his earnings.

NOTICE—A well established Placement Bureau assists both graduates and undergraduates to find positions.

Within Ten Months Increase Your Income

No special training or talent is required. In 10 months' time or less . . . we can train you . . . at home, in your spare hours . . . to be an expert Draftsman.

And remember this: In Drafting, a big income is open to every properly trained man. Thousands today are earning \$35 to \$100 per week. The reason is simple: Good Draftsmen are in constant demand.

Book of Facts FREE

We will send you a 40-page Book. It tells you all about Drafting . . . and our courses. What prominent men say . . . where Draftsmen are employed . . . their salaries . . . their opportunities . . . what our students have done and are doing . . . how many have increased their salaries even before finishing their courses . . . how many hold high-salaried executive positions today. Tells how 34 instructors give you from this recognized 22-year-old college a practical, short, home-study course.

The Coupon Below Means Money to You

Find out what Drafting may mean to you . . . mail [that coupon. Here is a field in which you can work and win.

We make the test easy, for, with no obligation, we send you a trial lesson FREE. Note the fairness of this offer, the absence of exaggerated promises.

\$25 Outfit Included

When you enroll, you will need drafting instruments; so included in the cost of the course, is a \$25 "lifetime" set. If you have instruments, credit will be allowed. Note that we do not claim to give you these instruments "free". Tuition is low, payments easy.

In Chicago—Earn While You Learn

Those who can come to Chicago will find opportunity to earn living expenses in part-time positions, outside of school hours, while attending day or evening classes at the College.

Chicago Technical College, founded 1904, is known as one of America's oldest and largest schools of specialized engineering. Over 1000 men enroll in resident day and evening courses yearly.

Diplomas in Civil, Mechanical and Electrical Engineering and Architecture granted after two years. Degree of B. S. conferred after three years in the day course. Short courses offered in Drafting, Plan Reading, Estimating, etc. Evening classes for day workers.

If interested in attending Day or Evening Classes at the College in Chicago write for 72-page "Blue Book"—mailed free.

Send Today for FREE Trial Lesson
Fill Out the Attached Coupon NOW

Chicago TECHNICAL College

Drafting—Engineering—Electricity—Architecture . . . all branches

Chicago Technical College,
Dept. 131, 118 E. 26th St., Chicago, Ill.

Send me, without cost or obligation, your
FREE Trial Lesson and your 40-page Book
of Facts about Drafting.

Name

Address

City and State

Prize Winning Letter in the November Contest

Five members of the World Opportunities' Society will receive scholarships in the Coyne Electrical School as a result of Mr. Calder seeing this school's advertisement in the columns of POPULAR SCIENCE MONTHLY. Here is Mr. Calder's letter which wins the first prize of \$50.00 in the November Contest:—

DEAR SIR:

The advertisement of Coyne Electrical School in the Money Making Opportunities' Department caught my interest because it offers a permanent and progressive opportunity—a well paid profession of constructive service.

I decided to investigate their offer. I called at the school and found it an institution of such merit that I was most favorably impressed.

This I reported to the Committee on Scholarship of our Fraternal Order. Upon deliberation the Committee decided to offer five annual scholarships in the Coyne School for our members.

See what that one advertisement accomplished!

Yours truly,

M. CALDER.

World Opportunities' Society, Chicago, Illinois.

Complete List of Prize Winners In the November Contest

FIRST PRIZE \$50

M. Calder, Chicago, Ill.
(Coyne Electrical School)

SECOND PRIZE \$25

Russell S. Lundeen, Forest Lake, Minn.
(Niagara School of Music)
(American School of Aviation)

THIRD PRIZE \$10

Peter Herzig, Hawleyville, Conn.
(Theo Audel & Co.)

PRIZE WINNERS who received \$1.00 each for their letters—

Leland Perry, Cedar City, Utah.
(Chicago Engineering Works)

William F. Sandmann, Ft. Wayne, Ind.
(Victor J. Evans & Co.)

Frank S. Cerny, Chicago, Ill.
(American Correspondence School)

Arthur W. Zabel, Eagle Rock, Calif.
(International Correspondence School)

M. H. Johnson, Omaha, Nebr.
(Allied Merke Institute, Inc.)

Harold F. Reed, Niagara Falls, N. Y.
(Victoria Stamp Co.)

J. N. Lawrence, Mare Island, Calif.
(Pathfinder Publishing Co.)

Elna Sauer, Denver, Colo.
(The Weldon Fire Gun)

Lyman Michaels, Bristol, Conn.
(Theo Audel & Co.)

Harry B. Stillman, Plainville, Conn.
(International Correspondence School)

Elmer Evans, Springfield, Ohio.
(International Studios)

Leon C. Merryfield, Burgoon, Ohio
(Northwestern School of Taxidermy)

A. S. Bailey, Houston, Texas
(National Salesmen's Training Association)

Charles M. Reynolds, Spruce Creek, Pa.
(Chicago Engineering Works)

Clarence H. Christopherson, Delavan, Minn.
(Coyne Electrical School)

Electrical Experts are in Big Demand!
—L.L. Cooke!

I Will Train You at Home to fill a Big-Pay Job!



Look What These Cooke Trained Men Are Earning



Makes \$700 in 24 Days in Radio

"Thanks to your interesting Course I made over \$700 in 24 days in Radio. Of course, this is a little above the average but I run from \$10 to \$40 clear profit every day, so you can see what your training has done for me."

FRED G. McNABB, 848 Spring St., Atlanta, Georgia



\$70 to \$80 a week for Jacquot

"Now I am specializing in Auto Electricity and battery work and make from \$70 to \$80 a week and am just getting started. I don't believe there is another school in the world like yours. Your lessons are a real joy to study."

ROBERT JACQUOT, 2035 W. Colorado Ave., Colorado Springs, Colo.



\$20 a Day for Schreck

"Use my name as a reference and depend on me as a booster. The biggest thing I ever did was answer your advertisement. I am averaging better than \$500 a month from my own business now. I used to make \$18.00 a week."

A. SCHRECK, Phoenix, Arizona



Plant Engineer—Pay raised 150%

"I was a dumbbell in electricity until I got in touch with you Mr. Cooke, but now I have charge of a big plant including 600 motors and direct a force of 34 men—electricians, helpers, etc. My salary has gone up more than 150%."

GEORGE ILLINGWORTH, 63 Calumet Road, Holyoke, Mass.

It's a shame for you to earn \$15 or \$20 or \$30 a week, when in the same six days as an Electrical Expert you could make \$70 to \$200—and do it easier—not work half so hard. Why then remain in the small-pay game, in a line of work that offers no chance, no big promotion, no big income? Fit yourself for a real job in the great electrical industry. I'll show you how.

Be an Electrical Expert Earn \$3,500 to \$10,000 a Year

Today even the ordinary Electrician—the "screw driver" kind—is making money—big money. But it's the trained man—the man who knows the whys and wherefores of Electricity—the Electrical Expert—who is picked out to "boss" the ordinary Electricians—to boss the Big Jobs—the jobs that pay \$3,500 to \$10,000 a Year. Get in line for one of these "Big Jobs." Start by enrolling now for my easily learned, quickly grasped, right up-to-the-minute, Spare-Time Home-Study Course in Practical Electricity.

Age or Lack of Experience No Drawback

You don't have to be a College Man; you don't have to be a High School Graduate. As Chief Engineer of the Chicago Engineering Works, I know exactly the kind of training you need, and I will give you that training. My Course in Electricity is simple, thorough and complete and offers every man, regardless of age, education, or previous experience, the chance to become, in a very short time, an "Electrical Expert," able to make from \$70 to \$200 a week.

No Extra Charge for Electrical Working Outfit

With me, you do practical work—at home. You start right in after your first few lessons to work at your profession in the regular way and make extra money in your spare time. For this you need tools, and I give them to you—5 big complete working outfits, with tools, measuring instruments, and a real electric motor—5 outfits in all.

Your Satisfaction Guaranteed

So sure am I that you can learn Electricity—so sure am I that after studying with me, you, too, can get into the "big money" class in electrical work, that I will guarantee under bond to return every single penny paid me in tuition, if, when you have finished my Course, you are not satisfied it was the best investment you ever made. And back of me in my guarantee, stands the Chicago Engineering Works, Inc., a two million dollar institution, thus assuring to every student enrolled, not only a wonderful training in Electricity, but an unsurpassed Student Service as well.

Get Started Now—Mail Coupon

I want to send you my Electrical Book and Proof Lessons, both Free. These cost you nothing and you'll enjoy them. Make the start today for a bright future in Electricity. Send in Coupon—NOW.

L. L. Cooke, Chief Engineer
Chicago Engineering Works
2150 Lawrence Ave.,
Dept. 31
Chicago



L. L. COOKE, The Man Who Makes "Big-Pay" Men
Dept. 31
2150 Lawrence Ave., Chicago

Send me at once without obligation your big illustrated book and complete details of your Home Study Course in Electricity, including your outfit and employment service offers.

MAIL COUPON FOR MY FREE BOOK

Name.....

Address.....

Occupation.....

5 big outfits given to you—no extra charge

The "Cooke" Trained Man is the "Big Pay" Man

Opportunities for Readers in Quick Action Advertising

ADDING MACHINES

FREE trial, marvelous new adding machine. Adds, subtracts, multiplies, divides automatically. Work equals \$350.00 machine. Price only \$15.00. Speedy, durable, handsome. Five-year guarantee. Used by largest corporations. Write today for catalog and free trial offer. Lightning Calculator Co., Dept. O, Grand Rapids, Michigan.

ADVERTISING SERVICES

ADVERTISE in 24 metropolitan dailies, 24 words, \$15.00. Helpful Guide listing 1000 publications, 4c stamps. Wade Company, Baltimore Bldg., Chicago.

24 WORD ad 355 rural weeklies, \$14.20. Ad-Meyer, 4112P Hartford, St. Louis.

COMBINATION Winner. 125 Magazines, 10c word, \$8.00 incl. Thrice, Interstate Advertiser, Munsing, Mich.

MR. ADVERTISER: Ask today for a copy of the "Quick-Action Advertising Rate Folder." It contains some really important facts which will prove interesting and valuable to you. It also tells "How You Can Use Popular Science Monthly Profitably." You'd like to know, wouldn't you? Address your inquiry to: Manager, Classified Advertising, Popular Science Monthly, 250 Fourth Avenue, New York.

ADVERTISING in all magazines and newspapers at publishers' lowest rates. Rate book free. Taylor's Advertising Service, Dept. 5, Freeport, Ill.

INCH display, 88 magazines \$2.00, thrice \$5.40. Smith's Service, Wenatchee, Wash.

ADVERTISE in 24 big Sunday Newspapers. 24 words \$15.00. Specializing in Magazine and Newspaper advertising at publishers' lowest rates. Lists and consultation free. National Service, Richmond Hill, New York.

AUTHORS AND MANUSCRIPTS

PHOTOPLAY—Story Ideas wanted. \$25-\$500 paid. Experience unnecessary; outline Free to anyone. Write Producers League, 312 St. Louis.

WRITERS—Stories, poems, plays, etc., are wanted for publication. Literary Bureau, 117, Hannibal, Missouri.

\$\$\$ FOR ideas. Photoplay plots accepted any form, revised, criticized, copyrighted, marketed. Advice free. Universal Scenario Corporation, 214 Security Bldg., Santa Monica and Western Avenue, Hollywood, California.

SHORT Stories, Articles, etc., typewritten and marketed. Hursh Service, Dept. 3, Box 1013, Harrisburg, Penna.

SONGS and song poems wanted. Radio Publicity Bureau, Box 24, Times Square Station, New York.

SONG Poem Writers send for proposition. Ray Hibbler, D10, 4040 Dickens Av., Chicago.

I WANT song poems. Casper Nathan, J-3544 No. Racine, Chicago.

AUTOMOBILES AND ACCESSORIES

DELIVERY bodies for Ford Model T Chassis with enclosed cab, suitable for Contractors, Grocersmen and Farmers. Three styles. Price \$37.50. Write Daniel Zimmerman, Craigville, Indiana.

SCIENTIFIC Gas Saver. All autos. 1 free to introduce. Critchlow, K-120, Wheaton, Ill.

CARBON-X will keep your engine "peppy" by keeping it free from carbon. Handy package and "Why Is Carbon?" postpaid for dollar bill. Money back if you want it. Carbon-X, Box 1953, Chicago.

AVIATION

DO you want a position where you can pay your way while learning to qualify as airplane mechanic or pilot? Send \$2.00 for one yearly subscription to Slipstream Monthly—The Flyers' Magazine and our employment service will help you get located. Only subscribers need apply. Slipstream Publishing Co., Dayton, Ohio.

MR. ADVERTISER: Ask today for a copy of the "Quick-Action Advertising Rate Folder." It contains some really important facts which will prove interesting and valuable to you. It also tells "How You Can Use Popular Science Monthly Profitably." You'd like to know, wouldn't you? Address your inquiry to: Manager, Classified Advertising, Popular Science Monthly, 250 Fourth Avenue, New York.

PROPELLERS for Airplanes, Wind Wagons, Snow and Ice Sleds, Wing Ribs, Correct Sizes and Tests to Build from. Dimensions, Small Airplanes, Crawford Aeroplane Manufactory, Long Beach, Calif.

The American School of Aviation announces a new correspondence course in mechanics of aviation. A thorough training in practical aeronautics. American School of Aviation, Dept. 6741, 3601 Michigan Ave., Chicago, Illinois.

BOYS get a three foot model aeroplane free. Write to Aero Shop, 3050 Hurlbut Ave., Detroit, Mich.

BOATS AND LAUNCHES

HUBBELL Marine Coolers convert Ford engines into marine motors. Ford dope free to boat owners. C. C. Hubbell, East Ave., Norwalk, Conn.

BLUE PRINTS

BLUE Prints of ships for Modelmakers, send for circular. G. B. Douglas, 165 Summit Ave., Upper Montclair, N. J.

TO the man who has a Home Workshop and likes to work with tools, Popular Science Monthly offers the opportunity to purchase blueprints giving details of the construction of useful articles for the home. The following are a few of the blueprints available: No. 1, Sewing Table, No. 5, Kitchen Cabinet, No. 13, Tea Wagon, No. 15, Workshop Bench, No. 17, Cedar and Mahogany Chest, No. 41, One Tube Radio Set, No. 42, Radio Receiver with three stages of amplification, No. 43, Four Tube Radio Receiver. Send 25c for each blueprint that you wish to Popular Science Monthly, 242 Fourth Avenue, New York, N. Y.

BRANCH OFFICE SERVICE

WASHINGTON mail address \$5 month. Established 1920. Address "Service", 605 District National Bank Building, Washington, D. C.

Rate 30 Cents a Word. A 10% discount is allowed on all contracts for six consecutive insertions. Advertisements intended for the Mar. 1926 issue should be received by Jan. 5th

BUSINESS OPPORTUNITIES

BATTERY shop equipment and supplies at wholesale. Adams-Barrs, Columbus, Ohio.

A new mail order book tells exactly how to start, grow and win. Latest methods explained, new ideas and pointers. Free circular tells all about it. MacRea, Publisher, 8058 Oregonian Bldg., Portland, Oregon.

PATENTS procured; Trade Marks Registered—A comprehensive, experienced, prompt service for the protection and development of your ideas. Preliminary advice gladly furnished without charge. Booklet of information and form for disclosing idea free on request. Richard B. Owen, 44 Owen Bldg., Washington, D. C., or 41-Z Park Row, New York.

BUSINESS Guide with free legal service sells everywhere. Wells cleared \$1,185 in 35 days. Write for free outfit. Nichols Co., Naperville, Ill., Dept. 1B.

MAKE Money! 150 Plans FREE! Wolverine Bureau. (C-3). Muskegon, Michigan.

SUCCEED With Your Own Products—make them yourself. Formulas, Processes by experts. Trade-Secrets. Modern master methods. Catalog free. C. Thaxly Co., Washington, D. C.

USED correspondence school courses. All kinds. Sold on re-purchase basis. Big saving. Money back guarantee. Lists free. (Courses bought.) Lee Mountain, Pisgah, Alabama.

MIRRORS re-silvered at home. Costs less than 5 cents per square foot; you charge 75 cents. Immense profits, plating auto parts, reflectors, tableware, stoves. Refinishing metal ware, etc. Outfits furnished. Write for information. Sprinkle, Plater 94, Marion, Indiana.

LEARN the collection business. Good income; quick results. Interesting booklet, "Skillful Collecting," free. National Collector's Association, Science Building, Newark, Ohio.

BECOME a Foot Correctionist. A New Profession not medical nor chiropody. All the trade you can attend to; many are making \$3000 to \$10,000 yearly, easy terms for training by mail, no further capital needed or goods to buy, no agency or soliciting. Address Stephenson Laboratory, 10 Back Bay, Boston, Mass.

WE start you in business, furnishing everything; men and women, \$80.00 to \$100.00 weekly operating our "New System Specialty Candy Factories" anywhere. Opportunity lifetime; booklet free. W. Hillyer Ragsdale, Drawer 19, East Orange, N. J.

STOP plodding! Be successful. Operate a tire repair shop. Make big profits in any locality. We teach you and furnish complete equipments, \$100 up. Book of Opportunity free. Haywood's, 1306 South Oakley Avenue, Chicago.

MR. ADVERTISER: Ask today for a copy of the "Quick-Action Advertising Rate Folder." It contains some really important facts which will prove interesting and valuable to you. It also tells "How You Can Use Popular Science Monthly Profitably." You'd like to know, wouldn't you? Manager, Classified Advertising, Popular Science Monthly, 250 Fourth Avenue, New York.

RESPONSIBLE manufacturer wants competent men to manage office and salesmen. \$300 to \$1500 necessary; will allow expenses to Trenton if you qualify. Address Manager, 536 Forst Richey Bldg., Trenton, N. J.

MANUFACTURE new, fast selling novelties, toys, preparations, mail order, agents goods. Free list reliable, plans, patterns, processes, commercial information. Manufacturers' Bureau, 3937C Tracy, Kansas City, Mo.

MAKE \$100 weekly in agreeable business of your own. Everything furnished. Particulars free. W. Abell, 141-The-Arcade-Cleveland, Ohio.

STOCK privilege trading offers large profits, \$100 up sufficient. Write Dept. R, Paul Kaye, 149 Broadway, New York.

\$50 a week. Mail Order business. Booklet tells how. Sample and plan 25c. Outfit furnished you FREE. Bradford Co., Dept. P, Shawnee, Okla.

ARE you old at forty? See our advertisement on page 130 of this issue. The Electro Thermal Company, 4053 Main Street, Steubenville, Ohio.

\$\$\$—Resilvering Mirrors. Trade-Secret 50 cents. Irwin, 47 Emilie, Branford, Ontario, Canada.

FREE Book. Start little mail order business. Pier, 976 Cortlandt Street, N. Y.

I MADE \$30 a week home. French bread-making, 15 years' experience. Free booklet tells. Ashbrook, E. 67, Marengo, Ohio.

\$50 WEEKLY. Your Own Business. Enormous Profits. Plan, Sample 50c. Suydam, P-10748, 112th Street, Richmond Hill, N. Y.

INCH Display Advertisement, 166 Magazines, year, \$50.00. Woods Poplar Service, Atlantic City.

MAKE \$100 to \$300 weekly locally and by mail in a fascinating high class business. Complete instructions sent for 25c. Address U. C. Service, Honesdale, Pa.

START small home Mail Order Business. Booklet 2c. Harvey Teeple, Decatur, Indiana.

BUSINESS SERVICES

CHARTERS—Delaware; best, cheapest; granted day received; free forms. Colonial Charter Co., Wilmington, Del. (99)

MR. ADVERTISER: Ask today for a copy of the "Quick-Action Advertising Rate Folder." It contains some really important facts which will prove interesting and valuable to you. It also tells "How You Can Use Popular Science Monthly Profitably." You'd like to know, wouldn't you? Address your inquiry to: Manager, Classified Advertising, Popular Science Monthly, 250 Fourth Avenue, New York.

CHALK TALKS

LAUGH producing program, \$1.00. Circulars free. Cartoonist Balda, Oshkosh, Wisconsin.

DISTRICT MANAGERS AND REPRESENTATIVES WANTED

WORLD'S fastest selling auto accessory! County distributors wanted; write to-day. G. L. W., Spring Oiler Co., San Diego, California.

DOGS

BEAUTIFUL registered bull pups cheap. Bulldogs, 501 Rockwood, Dallas, Texas.

EDUCATION AND INSTRUCTION

CORRESPONDENCE Courses. All Schools. Lowest prices. Terms. Catalog Free. Mention Subject. Economy Educator, 440-B Sansome, San Francisco.

USED correspondence school courses save over half. Bargain catalogue 1000 courses free. Used courses bought. Students' Exchange, Dept. A, 47 West 42d Street, New York.

"DOUBLE entry bookkeeping mastered in 60 hours with 8 keys; guaranteed; diploma." International Bookkeeping Institute, Desk 10, Springfield, Mo.

BOOKKEEPING in a week, \$2 complete. Dukes, 640 West 153d Street, New York.

FOR "Free Scholarship" (Mail Course), write Carnegie College, Rogers, Ohio.

CORRESPONDENCE Courses bought and sold. Hanfling, 799-X, Broadway, New York.

CORRESPONDENCE Courses sold complete; 1-3 usual prices because slightly used; easy terms; money back guarantee. All schools and subjects. Write for special Free catalog. Courses bought for cash. Economy Educator Service, 202-N, West 49th St., New York.

EARN \$25 weekly, spare time, writing for newspapers, magazines. Experience unnecessary. Copyright book free. Press Syndicate, 962, St. Louis, Mo.

SHORTHAND in four evenings. Arthol course seven dollars. Sent approval. Particulars, Hollefreund's School, Stratford, Ontario, Canada.

FOR BOYS

"AMATEUR ELECTRICIAN," 64 pages, (illustrated) "Toymaker Book," (illustrated) "Ford Joke Book"—all for 25c. Elsen, Publisher, Bowling Green, Ohio.

FORD ACCESSORIES

STOP that chucking. Ford runs smoothly at four miles. Starts instantly. "Nonchuck." Installed with wrench. \$1.00. Neutroe Co., Brighton, N. Y.

44 MILES on 1 Gallon—Wonderful Vapor Humidifier. All autos. 1 free to introduce. Critchlow, L-120, Wheaton, Ill.

FOR INVENTORS

INVENTOR'S Universal Educator—contains 900 mechanical movements; 50 perpetual motions. Tells how to obtain and sell patents. Suggests new ideas. Explains how to select your attorney and avoid patent sharks. Price (revised edition), \$2.00 postpaid. Albert E. Dietrich, 681 Ouray Bldg., Washington, D. C.

UNPATENTED Ideas Can be Sold. I tell you how and help you make the sale. Free particulars (Copyrighted). Write W. T. Greene, 805 Jenifer Building, Washington, D. C.

I SELL Patents. Established in 1900. Charles A. Scott, 773PS, Carson Avenue, Rochester, New York.

INVENTIONS Commercialized. Patented or unpatented. Write Adam Fisher Mfg. Co., 183 Enright, St. Louis, Mo.

GET Cash for your patent or invention under our new plan. Write at once to Inventors' Syndicate, 23 Palladium Bldg., St. Louis, Missouri.

PATENTS: My fee in instalments. Free personal advice. Frank T. Fuller, Washington, D. C.

GET Your Own Patents. Instructions, legal blanks, \$1. Cooper Cutting, Campbell, Calif.

SELL your patented or unpatented invention. Write for my three plans. Free. Hartley, 44 Central St., Bangor, Maine.

INVENTORS: The monthly reports we give keep you informed of latest developments towards Perpetual Motion. We supply new Standard parts reusable in constructing Perpetual or any other mechanical model. Write for interesting information. Progressive Association, Box 8-86, Westville, Conn.

FOR MEN AND WOMEN

DETECTIVES—Work home or travel. Experience unnecessary. Write, George Wagner, former Government Detective, 1968P Broadway, N. Y.

ARE you old at forty? See our advertisement on page 130 of this issue. The Electro Thermal Company, 4053 Main Street, Steubenville, Ohio.

BEAUTIFUL handwritten cards, your name. Send quarter for sample dozen to EXPERT PENMAN MEUB, 2365 Mar Vista, Pasadena, Calif.

FORMULAS

ANY one formula, 25c. Pittman Laboratory, Formula Dept., Parkville, Kentucky.

FOR SALE

FOR Sale: Watchmaker's Lathe at a bargain. R. Jaegermann, 5815 Easton Ave., St. Louis, Mo.

25c BARGAIN—3 beautiful miniature cacti, with illustrated catalogue of Desert plants. C. E. Pattison, 320 Tobin Place, El Paso, Texas.

MR. MANUFACTURER, layman or veteran—Side Dump Scraper Hoist, loads wagons, does ditching. E. B. Hawkins, Applegate, Oreg.



Money Talks!

About 100,000 people have tried this remarkable hair-growing method. Each had the privilege of getting his money back. Yet when the 30-day trial period expired—only 3 out of every 100 asked for a refund. And they got it instantly!

The same square guarantee is open to you. No strings—no loopholes—no alibis—no "ifs" or "buts" or "maybes"—if my new method doesn't grow new hair for you in 30 days—I'll send you my check refunding every penny you have paid and the trial will have cost you absolutely NOTHING!

I Guarantee YOU New Hair In 30 Days—Or I Pay All Costs!

By Alois Merke
Founder of Famous Merke Institute
Fifth Avenue, New York

GRASP this chance. Start now and save yourself from the tragedy of baldness. Let me prove to you—without a cent of risk—that you can grow new hair in 30 days!

An Amazing Contract

No matter how fast your hair is falling out—no matter how little of it is now left—no matter how many treatments you have tried without results,—I absolutely guarantee that my new method will give you new hair in 30 days or the trial costs you nothing!

Why I Make It

I have found during many years research and from experience gained in treating thousands of cases of baldness at the Merke Institute, Fifth Avenue, N. Y., that in most cases of loss of hair the roots are not dead—but merely *dormant*.

It is useless and a waste of time and money to try and get down to these under-nourished roots with the average tonic or with massages, crude oil, etc., for such measures only treat the *surface* of the skin.

My Method Gets To the ROOTS

But my scientific system involves the application of entirely new principles in stimulating *hair* growth. It penetrates below the surface of the scalp and gets right to the cause of most *hair* troubles—the starving, *dormant* roots. It provides not only an efficient way of reviving and invigorating these inactive roots, but of giving them the nourishment they need to grow hair again. And the fine thing about my system is the fact that it is simple and can be used in any home where there is electricity without the slightest *discomfort* or *inconvenience*.

No Cost If It Fails

Of course there are a few cases of baldness that nothing in the world can help. Yet so many hundreds of men and women whose hair was coming out almost by "handfuls" have seen their

hair grow in again as the shrunken roots acquire new life and vitality that I am willing to let you try my treatment at my risk for 30 days. Then if you are not more than delighted with the new growth of hair produced, write me immediately. Tell me my system has not done what I said it would, and the 30-day trial won't cost you a cent.

Free Booklet Tells All

The very fact that you have read this announcement shows that you are anxious about the condition of your hair. So why not investigate? Find out for yourself. If you will merely fill in and mail the coupon I will gladly send you without cost or obligation a wonderfully interesting booklet which describes in detail my successful system which is growing new hair for thousands all over the country. In addition it tells all about my iron-clad guarantee which enables you to take my treatment without a penny's risk. Clip and mail the coupon today. Allied Merke Institutes, Inc., Dept. 171, 512 Fifth Avenue, New York City.



Allied Merke Institutes, Inc.
Dept. 171, 512 Fifth Avenue, New York City

Please send me without cost or obligation a copy of your book, "The New Way to Grow Hair," describing the Merke System.

Name.....

Address.....

City..... State.....

RESULTS

Results Gratifying

"Ten years ago my hair started falling. I used hair tonics constantly, but four years ago I displayed a perfect full moon. I tried everything—but without results. Today, however, thanks to your treatment I have quite a new crop of hair one inch long."—F. H. B., New York

Hair About Gone

"My hair has been falling for the last two years and I had hardly any more hair on the front of my head. But since I started using your treatment I am raising a new crop of hair. Your treatment is best I ever saw."—O. J., Northbridge, Mass.

New Hair Growing

"Results are wonderful. My hair has stopped falling out and I can see lots of new hair coming in."—F. D. R., Washington, D. C.

New Hair on Bald Spots

"I have used Thermocap Treatment for 8 weeks and although the top of my head has been entirely bald for 6 years the results up to the present are gratifying. In fact the entire bald spot is covered with a fine growth of hair."—W. C., Kenmore, Ohio.

Can't Say Enough For It!

"Am glad to say I can see such great change in my hair. It is growing longer and my head is full of young hair that has made its way through since I have been using Merke Thermocap. I can't say enough for it. It will do everything you claim it to do."—G. G., Texas.

FOR THE HOME

BIG money in weaving Colonial rugs, quaint rag carpet, scarfs, etc. Home weavers are always busy. Looms now as low as \$9.90. Liberal Pay-As-You-Weave terms. Write today for free Loom Book. Union Loom Works, 482 Factory St., Boonville, N. Y.

GRANDFATHER clock works \$5.00. Build your own case, instructions free; make good profits selling your friends. Clock works with chimneys for old or new cases. Write for full particulars. Clock Co., Nicetown, Penn.

TO the man who likes to work with tools. Popular Science Monthly offers the opportunity to purchase blueprints giving details of the construction of useful articles for the home. The following are a few of the blueprints available: No. 1, Sewing Table, No. 5, Kitchen Cabinet, No. 13, Tea Wagon, No. 15, Workshop Bench, No. 17, Cedar and Mahogany Chest, No. 41, One Tube Radio Set, No. 42, Radio Receiver with three stages of amplification, No. 43, Four Tube Radio Receiver. Send 25c for each blueprint that you wish to Popular Science Monthly, 242 Fourth Avenue, New York, N. Y.

HELP WANTED

SILVERING Mirrors, French plate. Easily learned immense profits. Plans free. Wear Mirror Works, Excelsior Springs, Mo.

MR. BRUSH Salesmen:—Old Established New York Brush Manufacturer requires the services of men in all territories to sell their extensive line of Sanitary Twisted in Wire Brushes. We pay larger commissions than any other Brush House in the country. Write immediately for our proposition. Wire Grip Sanitary Brush Corp., 15 Mercer St., New York.

MEN wishing to enter dining, sleeping car service as conductors, porters, waiters, write 123 Railway Exchange, Kansas City.

WANTED—Representatives in every factory in the United States. Popular Science Monthly, 250 Fourth Ave., New York.

EARN \$10 to \$30 weekly mailing circulars at home. Outfit and instructions, 25c coin. Survinal, 4731-2 S. Arlington, Akron, O.

HELP WANTED INSTRUCTION

U. S. GOVERNMENT Jobs. Railway Mail Clerks—Mail Carriers. \$1700-\$2700 year. Steady. Men 18 up. Sample coaching—FREE. Write immediately. Franklin Institute, Dept. K-34, Rochester, N. Y.

DETECTIVES Earn Big Money. Excellent opportunity. Travel. Fascinating work. Experience unnecessary. Write George Wagner, former Government Detective, 1968P, Broadway, N. Y.

FIREMEN, Brakemen, Baggage men, Sleeping car, train porters (colored) \$140—\$200. Experience unnecessary. 838 Railway Bureau, East St. Louis, Ill.

HOW TO ENTERTAIN

PLAYS, musical comedies and revues, minstrel music, blackface skits, vaudeville acts, monologs, dialogues, recitations, entertainments, musical readings, stage handbooks, make-up goods. Big catalog free. T. S. Denison & Co., 623 So. Wabash, Dept. 26, Chicago.

INCORPORATIONS

INCORPORATE Delaware. F. Lewis Mettler, 832 Market St., Wilmington, Del. (Established 1909.)

DELAWARE Incorporator. Charters: Fees Small; forms. Chas. G. Guyer, 901 Orange St., Wilmington, Delaware.

INFORMATION

\$1,000 worth information circular, free. Lakeside Bureau, 80 Lake, Webster, Mass.

"MR. ADVERTISER: Ask today for a copy of the 'Quick-Action Advertising Rate Folder.' It contains some really important facts which will prove interesting and valuable to you. It also tells 'How You Can Use Popular Science Monthly Profitably.' You'd like to know, wouldn't you? Address your inquiry to: Manager, Classified Advertising, Popular Science Monthly, 250 Fourth Avenue, New York.

INSECTS WANTED

WHY not Spend Spring, Summer and Fall gathering butterflies, insects? I buy hundreds of kinds for collections. Some worth \$1 to \$7 each. Simple outdoor work with my instructions, pictures, price-list. Send 10 cents (not stamps) for my Illustrated Prospectus before sending butterflies. Mr. Sinclair, Dealer in Insects, Box 1424, Dept. 7, San Diego, California.

INVENTIONS FOR SALE

TWO inventions for sale on woodworking tool. John Szako, 219 Grand Central Place, Long Island, N. Y.

LABORATORY AND CHEMICAL SERVICES

GUARANTEED Reliable Formulae, Trade Secrets, Rare, Dependable Manufacturing Processes for all lines—detailed working directions, "inside" commercial information. Don't buy till I've sent you my valuable Literature, Lists. Satisfaction Guaranteed. Dr. Liscomb Miller, Industrial Chemist, Tampa, Florida.

ADVICE from engineers will save you from making costly mistakes in buying radio and tool equipment. Write to Popular Science Institute, 246 Fourth Ave., New York City, for list of tested and approved products. See page 6.

YOUR chemical problem solved and working process furnished for \$5.00. Write me. W. Stedman Richards, Consulting Chemist, Box 2402, Boston, Mass.

MELT steels, nickel, brass, gold, and other alloys. Electric melting furnaces prices from \$75.00. Speedee-Heat Electric Furnaces, 411 N. Wells St., Chicago, Ill.

LANGUAGES

WORLD-ROMIC System, Masterkey 5,000 languages, Primers \$1.98. Chinese, French, Spanish—Languages, 8 West 40th, New York.

LETTER SPECIALISTS

I WRITE letters, folders, booklets, complete followup for manufacturers, mail order dealers. Long experience. Write for details. L. Taylor, Box 844, Freeport, Ill.

LISTS

NAMES, postcards, cuts. Ben Meyer, 35 West 31st St., New York.

MR. ADVERTISER: Ask today for a copy of the 'Quick-Action Advertising Rate Folder.' It contains some really important facts which will prove interesting and valuable to you. It also tells 'How You Can Use Popular Science Monthly Profitably.' You'd like to know, wouldn't you? Manager, Classified Advertising, Popular Science Monthly, 250 Fourth Avenue, New York.

MACHINE TOOLS

No. 60 HEALD Auto Cylinder Grinder, \$750.00; no. 2 Cincinnati Milling machine, \$275.00; 24" Handy Shaper, \$325.00; 16"x8" Bradford Engine lathe, \$300.00; Barnes 20" Drill Press, \$55.00; 24" Woodworker Planer, \$175.00; 26" Band Saw, \$5.00; Terms to suit on single machine or complete shop. Complete line of machinery and supplies. Cincinnati Machinery & Supply Co., 218 E. Pearl St., Cincinnati, Ohio.

MAGIC TRICKS

BE a magician, give shows, earn money. Catalogue 20 cents. Oaks Magical Co., Dept. 550, Oakbrook, Wis.

MAGIC goods, cards, books, novelties, tricks. Catalog free. A. Fenner, 2401 Jefferson, Louisville, Ky.

MAIL ORDER BUSINESS

\$3000 extra a year, home evenings, I made it Mail Order Business. Advertising Booklet for stamp explains. Sample and plan 25c. Alps Scott, Cohoes, N. Y.

25 MONEY making ideas. Mail order supply sources. 10c. I Demuth, Company, Englewood, N. J.

MR. ADVERTISER: Ask today for a copy of the 'Quick-Action Advertising Rate Folder.' It contains some really important facts which will prove interesting and valuable to you. It also tells 'How You Can Use Popular Science Monthly Profitably.' You'd like to know, wouldn't you? Manager, Classified Advertising, Popular Science Monthly, 250 Fourth Ave., New York.

MANUFACTURING

DEVELOPING ideas and manufacturing our specialty. Absolute satisfaction. 33 years' experience; write us. The K. & B. Die & Specialty Co., 2018 Elm St., Cincinnati, Ohio, Dept. C.

ADVICE from engineers will save you from making costly mistakes in buying radio and tool equipment. Write to Popular Science Institute, 246 Fourth Ave., New York City, for list of tested and approved products. See page 6.

WANTED light manufacturing and experimental work. Prices guaranteed to be cheapest in America. Send models or drawings for quotations. Mele's Mfg. Co. Station A, New Haven, Conn.

MANUFACTURING, Models, Dies, Stamping, Brass Work, one or thousands. Baum's Metal Specialists, Kansas City, Mo.

MISCELLANEOUS

FORMS to cast Lead Soldiers, Indians, Marines, Trappers, Animals, 151 kinds. Send 10c for Illustrated Catalogue. Henry C. Schlerke, 1034 72nd St., Brooklyn, N. Y.

WANTED—Representatives in every factory in the United States. Popular Science Monthly, 250 Fourth Ave., New York.

MINERAL Treasure under foot! Find it! Cash it! Information 10c. Minerals identified \$1.00. Mineral specimens. Buskin, Geologist, Joplin, Mo.

MODELS AND MODEL SUPPLIES

HULIT & CO., 625 Jackson, Chicago, Ill. Experimental Machinists. Model Makers. Dies. Patterns. Complete general Machine shop. Ex-Lamson.

WE make working models for inventors and experimental work, and carry a complete stock of brass gears and model supplies. Send for catalogue. The Pierce Model Works, Tinley Park, Illinois.

MODEL steam engines, boilers and model pipe line fittings. Model making supplies. Send 20c for this year's illustrated catalogue handbook. Bathe Mfg. Co., Dept. C., 5214 Woodland Ave., Philadelphia, Pa.

MOTORCYCLES, BICYCLES, SUPPLIES

OVERSTOCKED Used Motorcycles, 1923 Indian Chief, \$95.00, 1923 Harley Davidson, \$95.00, 1923 Henderson Deluxe \$120.00. Two hundred others, write for free list. Myerow Brothers Co., 14 Berkeley St., Boston, Mass.

DON'T buy a bicycle motor attachment until you get our catalogue and prices. Shaw Mfg. Co., Dept. 4, Galesburg, Kansas.

MR. ADVERTISER: Ask today for a copy of the 'Quick-Action Advertising Rate Folder.' It contains some really important facts which will prove interesting and valuable to you. It also tells 'How You Can Use Popular Science Monthly Profitably.' You'd like to know, wouldn't you? Manager, Classified Advertising, Popular Science Monthly, 250 Fourth Ave., New York.

MOTORS, ENGINES AND MACHINERY

GUARANTEED: 1/4 HP., 110-volt, 60 cycle, single phase, used motors with pulley, at \$7.50 each. Also brand new 1/4 HP., 110-volt, Westinghouse make at \$13.75 each. Brand new 1 KW Westinghouse, 32-volt, 1150 speed, light and power generators at \$48.00 each. 25% cash, balance C. O. D. We have special prices on 32-volt motors. We repair and rewind electric motors and generators, etc. Bargains on electric fans. General Distributing Co., Security Storage Bldg., Duluth, Minn.

MUSICAL

SAXOPHONISTS — Clarinetists — Cornetists — Trombonists — get "Free Pointers." Virtuoso Music School, Buffalo, N. Y.

OPTICAL GOODS

ARTIFICIAL eyes. Booklet free. Denver Optic 508 Barclay, Denver, Colorado.

OFFICE DEVICES

ADDRESSING machines, multigraph, duplicators, folders, check writers, sealers, dictating machines, at about half new cost. Pruitt, 117N Market St., Chicago.

PATENT ATTORNEYS

PATENTS—Time counts in applying for patents. Don't risk delay in protecting your ideas. Send sketch or model for instructions or write for FREE book, "How to Obtain a Patent" and "Record of Invention" form. No charge for information on how to proceed. Communications strictly confidential. Prompt, careful, efficient service. Clarence A. O'Brien, Registered Patent Attorney, 184-F Security Bank Building (directly across street from Patent Office), Washington, D. C. (See page 139)

PATENT Sense—as one of the oldest patent firms in America we give inventors at lowest consistent charge, a service noted for RESULTS, evidenced by our many well-known Patents of extraordinary value. Book, PATENT-SENSE, free. Lacey & Lacey, 648 F St., Washington, D. C. Established 1869.

PATENT ATTORNEYS

PATENTS—Before disclosing an invention the inventor should write for our blank form "Record of Invention." This should be signed, witnessed and returned to us together with model or sketch and description of the invention for Free Inspection and Instructions. Our Three Books mailed free to inventors. Our Illustrated Guide Book, "How to Obtain a Patent," contains full instructions regarding patents. Copies of unsolicited letters from manufacturers and others who are constantly writing us regarding the purchase or leasing of meritorious patents sent upon request. See advertisement on page 141. Victor J. Evans & Co., 937 Ninth, Washington, D. C.

"INVENTOR'S Adviser," the valuable Patent book with 139 mechanical movements and illustrations, sent free upon request—M. S. Labiner, Patent Attorney, 3 Park Row, New York.

PATENTS, trade marks, copyrights. Prompt, personal reliable service. Over 30 years' active practice. Write for terms. Book free. Address E. G. Siggers, Box 1, N. U. Building, Washington, D. C.

PATENTS. Booklet free. Highest references. Best results. Promptness assured. Watson E. Coleman, Patent Lawyer, 644 G. Street, Washington, D. C.

INVENTORS' Guide free on request; gives valuable information and advice for all who have original ideas or improvements. Frank Lederman, Registered Attorney and Engineer. Woolworth Bldg., 1714, New York.

PATENT Book Free. Charles W. Lovett, Patent Attorney, Lynn, Mass.

UNPATENTED Ideas Can Be Sold. I tell you how and help you make the sale. Free particulars (Copyrighted 1923). Write W. T. Greene, 811 Jenifer Building, Washington, D. C.

MILLIONS spent annually for ideas! Hundreds now wanted! Patent yours and profit! Write today for free book—tells how to protect yourself, how to invent, ideas wanted, how we help you sell, etc. American Industries, Inc., 501 Kresge Bldg., Washington, D. C.

PATENTS, Trade-Marks, all countries. Ten years' experience examining applications in Patent Office. Consultation invited. George Beeler, Patent Attorney, 150 Nassau Street, New York.

ESTABLISHED 1864. Milo E. Stevens Company. Free Booklet, Patents, Trade-Marks, Copyrights. Offices. Monadnock Block, Chicago; Barrister Building, Washington, D. C.

INVENTORS—Send for form "Evidence of Conception" to be signed and witnessed. Form, fee schedule, information free. Lancaster and Allwine, Registered Patent Attorneys in United States and Canada, 232 Ouray Bldg., Washington, D. C.

PATENTS Procured: Trade Marks Registered.—A comprehensive, experienced, prompt service for the protection and development of your ideas. Preliminary advice gladly furnished without charge. Booklet of information and form for disclosing idea free on request. Richard B. Owen, 44 Owen Bldg., Washington D. C., or 41-Z Park Row, New York.

HERBERT JENNER, patent attorney and mechanical expert, 606 F. Street, Washington, D. C. I report if patent obtainable and exact cost. Send for circular.

PATENTS: My fee in instalments. Free personal advice. Frank T. Fuller, Washington, D. C.

MONROE E. MILLER, Ouray Bldg., Washington, D. C., Patent Lawyer, Mechanical, Electrical Expert. Booklet and Priority Record blank gratis.

PATENTS—Send for form "Evidence of Conception" to be signed and witnessed. Form, fee schedule, information free. Lancaster and Allwine, Registered Patent Attorneys in United States and Canada, 232 Ouray Bldg., Washington, D. C.

PATENTS FOR SALE

JUST Patented! Wonderful Combination Chiropractic Table. Two complete Tables in one. Every Druggist Doctor a Prospect. A fortune can be made from this invention. Hancil Cordrey, Chula Vista, Calif.

PHOTOGRAPHY AND SUPPLIES

HAVE you a camera? Write for free sample of our big magazine, showing how to make better pictures and earn money. American Photography, 117 Camera House, Boston, 17, Massachusetts.

ESTABLISH yourself at home, as a photographic expert; make \$75 a week while learning; professional camera furnished free; write quick for full information. International Studios, Dept. 1743, 3601 Michigan Ave., Chicago.

MR. ADVERTISER: Ask today for a copy of the 'Quick-Action Advertising Rate Folder.' It contains some really important facts which will prove interesting and valuable to you. It also tells 'How You Can Use Popular Science Monthly Profitably.' You'd like to know, wouldn't you? Address your inquiry to: Manager, Classified Advertising, Popular Science Monthly, 250 Fourth Ave., New York.

PHOTOGRAPHS made from Sketches or Ideas. Photos for artists. Strucketts, 749 Dundas, London, Ont.

UNEXCELLED Gloss Prints. Trial Offer. Your Kodak Film Developed and Printed only 10c. F. R. B. Photographers, Dept. "G," 1503 Lincoln Ave., Cincinnati, Ohio.

PRINTING AND ENGRAVING

1,000 Letterheads, Envelopes, Cards, \$3.00 postpaid; 500, \$2.25. Samples Free. Artservis Press, 66 Houghton, Worcester, Mass.

HIGH Grade Printing—5,000 20-lb. Hammermill, Bond Letter Heads, \$13.75; 10,000, \$24.00. 6 1/4 white wove envelopes, one thousand, \$2.25. The Courier Company, Zanesville, Ohio.

MONEY making business forms sent free. Cornish, Schenectady, N. Y.

200 Business Envelopes \$1.00. Commercial size, for business use. Name, business and address. Prompt service. List of 10 Big Dollar Specials Free. P. S. Kendall, Elmira, N. Y.

BETTER Printing for Less Money. Write us about your printing needs, and you will save money. Ernest Pantus Company, 525 South Dearborn Street, Chicago.

EARN \$25 weekly, spare time, writing for newspapers, magazines. Experience unnecessary. Copyright book free. Press Syndicate, 962, St. Louis, Mo.

RAZORS AND BLADES

1,000 SHAVES from one razor blade. Secret 25c. Barber, Box 1278, San Francisco.

Chief Engineer Dunlap

I will make this contract with you —

Your name here Wm. C. Campbell

When you enroll for my home-training in **ELECTRICITY** I agree to give you:

1. Complete training, including Electrical Engineering, Ignition, Radio, etc.
2. Four outfits of standard tools and materials, including a \$10 motor.
3. **I WILL HELP YOU GET A GOOD JOB AND A RAISE IN PAY.**
4. —or I will refund every cent of your money.

By Chief Engineer Dunlap

AMERICAN SCHOOL
—the Million Dollar Educational Institution



send you 4 Costly Electrical Outfits!

The third outfit is a \$10 Motor—the same type as the big fellows in a power plant

The first two outfits prepare you to do House-wiring jobs like these

The Fourth Outfit is a Standard Radio Set which you must assemble from regular wiring diagrams

Electrical Home-Training

Now Backed with **FREE JOB SERVICE**

I am pushing thousands of men ahead to success in Electricity by a wonderful new method of home-training. Now we announce a new feature for students and graduates of the American School—a nation-wide Employment Service under the direction of Mr. A. H. Burgkart, Job Expert. Burgkart is placing men in fine Electrical positions as fast as they qualify. The Electrical business needs more Experts. Go into Electricity and you're sure to find a good job when you're ready for it. **You can get ready with Dunlap Job-Method training:**

1.—because it's complete

We guarantee this training up-to-date and complete. Without extra charge I give you Electrical Engineering subjects, Electrical Drafting, Ignition, Radio, and many business subjects.

2.—because prepared by 23 noted Engineers

This is no one-man, one-idea school. America's greatest Electrical Engineers helped me prepare this training, and their work vouches for its high standard and thoroughness.

Instruction prepared by men from:

1. General Electric Co.	7. Western Electric Co.
2. Commonwealth Edison	8. Underwriters Lab.
3. Crocker-Wheeler Co.	9. Columbia University
4. Cutler-Hammer Mfg. Co.	10. Dartmouth College
5. American Telephone & Telegraph Co.	11. Massachusetts Inst.
6. Westinghouse Electric & Mfg. Co.	12. Lehigh University
	13. University of Vermont
	14. Armour Institute
	15. University of Kansas

3.—because I train you by the Job-Method

These pictures show how my students learn Electricity by doing actual Electrical jobs with standard materials and tools which I supply without extra cost. **Four costly outfits given!** Students make fast progress by this wonderful Job-Method. Many do similar jobs for pay in their spare time and earn more than enough to pay for this training.

Small Monthly Payments

Our educational standards are high, tuition is within reach of the untrained man who needs this training, and small monthly payments accepted. So you need not face the world without training—let me show you how to get this million dollar No-Profit institution back of you in your fight for success and independence.

Get My JOB AND RAISE Contract—Quick!

Now you can put your time and money into home-training with a positive agreement that it will lead to a better job and increased pay. Get the facts about my amazing offer. Find out about the opportunities and jobs waiting for you in Electricity. Act quickly and make the next few months the turning point in your life. Coupon brings complete information.

Send JOB and RAISE Contract

To.....

St. No..... State.....

City.....

(Mail immediately to Chief Engineer Dunlap, American School, Dept. E-175, Drexel Ave. and 58th St., Chicago)

Copyrighted material

SALESMEN AND AGENTS WANTED

AGENTS—Make a dollar an hour. Sell Mendota, a patent patch for instantly mending leaks in all utensils. Sample package free. Collette Mfg. Co., Dept. 467, Amsterdam, N. Y.

EARN \$10 daily silvering mirrors, plating and refinishing metal ware, headlights, chandeliers, bedsteads. Outfits furnished. F. Decie Laboratories, 1133 Broadway, New York.

AGENTS—Write for free samples. Sell Madison "Better-Made" Shirts for large Manufacturer direct to wearer. No capital or experience required. Many earn \$100 weekly and bonus. Madison Mfgs., 566 Broadway, New York.

WE start you without a dollar. Soaps, extracts, perfumes, toilet goods. Experience unnecessary. Carnation Co., Dept. 21, St. Louis.

AGENTS—Clever invention! Inkspoon makes every pen a fountain pen. Fast office seller, big profit, demand increasing everywhere. Exclusive territory offered. Sample free. H. Marul Company, Tribune Building, New York.

INSTANT Weld—Repairs large punctures without cement or heat. Lenn's profit one day \$56. Write quick. Free sample. Territory going fast. Tourist's Pride Mfg. Co., Desk R, Minneapolis, Minnesota.

BIG money and fast sales. Every owner buys gold initials for his auto. You charge \$1.50; make \$1.35. Ten orders daily easy. Write for particulars and free samples. American Monogram Co., Dept. 47, East Orange, New Jersey.

AGENTS, both sexes, we manufacture and control new household article. Fast seller. Big profits. Exclusive territory. Write now. Connolly, 123 Liberty St., New York.

WE pay \$48 a week, furnish auto and expenses to introduce our Soap and Washing Powder. Buss-Beach Company, Dept. A48, Chippewa Falls, Wis.

GET our free sample case toilet articles, perfumes and specialties. Wonderfully profitable. La Derma Co., Dept. F, St. Louis, Missouri.

AGENTS: Big profits. Best and cheapest window letters made. Easily applied. Dime brings five samples. Particulars free. Stalbrit Company, 1115 Second Avenue, New York.

ONLY one sale a day means \$200 per month! Marvelous new adding machine. Retail \$15.00. Work equals \$350 machine. Adds, subtracts, multiplies, divides, automatically. Computes feet and inches. Speedy, accurate, durable, handsome. Five year guarantee. Offices, stores, factories, garages, lumbermen buy one to dozen. A fortune for live agents. Write quick for protected territory and free trial. Lightning Calculator Co., Dept. P, Grand Rapids, Michigan.

WONDERFUL invention eliminates needles for phonographs. Preserves records. Abolishes scratching. Day's supply in pocket. \$20 daily. Sample on approval if requested. Evernplay, Desk G-1, McClure Bldg., Chicago.

ROBT. H. INGERSOLL of \$1 Watch Fame wants good men to sell his Dollar Stropping outfit, an ingenious invention for sharpening all makes of safety razor blades. Great Economic value. Meeting with nationwide approval. Easy to sell. Big repeat business. Agents having remarkable success. Full particulars. Robert H. Ingersoll, 476D Broadway, New York City.

WASH Clothes the new way. Use the Torrent Automatic Washer. You will be delighted. Special offer to one in each locality. Storm Royalty Co., 3614 Enright Ave., St. Louis, Mo.

300% PROFIT Selling Mitchell's Magic Marvel Washing Compound. Men and women clearing hundreds weekly. Wonderful seller. Big repeater. Nature's mightiest cleanser. Free sample. L. Mitchell, Drawer 1308, E. 61st Street, Chicago.

SELL widely advertised Skat paste soaps, toilet soaps, cleansers, polishers, etc. New allowance and commission plan insured success. Skat Company, Hartford, Conn.

65c. PROFIT every dollar! Minute demonstration makes sale. Homes, stores, offices, factories, etc. Big repeater. Free sample offer. Mallard Chem. Co., B, St. Louis, Mo.

AGENTS. \$60 = \$200 a week. Genuine gold letters for store windows easily applied. Free samples. Liberal offer to general agents. Metallic Letter Co., 434-A, N. Clark, Chicago.

GET our plan for monogramming automobiles, trucks, hand luggage and all similar articles by transfer method; experience unnecessary; exceptional profits. Motorists' Accessories Company, Mansfield, Ohio.

POLMET POLISHING CLOTH cleans all metals. Sells fast at 25c. Sample free. F. C. Gale, 15 Edinboro St., Boston.

MR. ADVERTISER: Ask today for a copy of the "Quick-Action Advertising Rate Folder." It contains some really important facts which will prove interesting and valuable to you. It also tells "How You Can Use Popular Science Monthly Profitably." You'd like to know, wouldn't you? Address your inquiry to: Manager, Classified Advertising, Popular Science Monthly, 250 Fourth Avenue, New York.

\$10 DAILY silvering mirrors, plating and refinishing lamps, reflectors, autos, beds, chandeliers by new method. Outfits furnished. Write Gunmetal Co., Ave. F, Decatur, Illinois.

AGENTS—Best seller; Jem Rubber Repair for tires and tubes; supersedes vulcanization at a saving of over 800 per cent; put it on cold, it vulcanizes itself in two minutes, and is guaranteed to last the life of the tire or tube; sells to every auto owner and accessory dealer. For particulars how to make big money and free sample, address Amazon Rubber Co., 504 Amazon Building, Philadelphia, Pennsylvania.

SELL high grade stationery. Particulars free. W. F. Messenger, Dept. P., Stillwater, N. Y.

TAKE orders for coffee, sugar, flour, meats, canned goods, staple groceries, also paints, radio sets, tires, auto and tractor oils. No capital or bond required. We deliver and collect. Permanent business. Big pay. Write at once. Hitchcock-Hill Co., Dept. 81, Chicago.

BANKRUPT and Rummage Sales. Make \$50.00 daily. We start you, furnishing everything. Distributors Dept. 34, 609 Division, Chicago.

AGENTS—Steady income. Large manufacturer of handkerchiefs and dress goods, etc., wishes representative in each locality. Factory to consumer. Big profits, honest goods. Credit given. Send for particulars. Freeport Mfg. Co., 24 Main St., Brooklyn, N. Y.

SALESMEN AND AGENTS WANTED

AUTOMOTIVE specialty salesmen. Year round steady profits. Adams-Barrs, Columbus, Ohio.

A BUSINESS of your own. Make and sell chipped glass name and house number plates, checkerboards, signs. Booklet FREE. E. Palmer, Dept. 513, Wooster, Ohio.

\$10,000 YEARLY. Manufacturer World's Greatest Envelope Sealer. Sells \$4.50. Tremendous Demand! Big Repeats. Write quick for exclusive territory. Red-E, 2036 Nottingham Bldg., Boston.

SELLS for \$9.75. Prints ad on wrapping paper, envelopes, etc. \$4.00 commission. Send 10c for sample work. Automatic Ad-Stamp, Joplin, Mo.

LIGHTNING Electrolyte. Charges storage batteries instantly. Guaranteed not to injure battery. Gallon costs 50c, sells \$10.00. Chance to clean up fortune selling to garages and agents. Make it yourself. Guaranteed formula \$5.00. Write for free circulars. Murphy, Chemist, Tujunga, Calif., Box-K.

MR. ADVERTISER: Ask today for a copy of the "Quick-Action Advertising Rate Folder." It contains some really important facts which will prove interesting and valuable to you. It also tells "How You Can Use Popular Science Monthly Profitably." You'd like to know, wouldn't you? Address your inquiry to: Manager, Classified Advertising, Popular Science Monthly, 250 Fourth Avenue, New York.

WANTED—Representatives in every factory in the United States. Popular Science Monthly, 250 Fourth Ave. New York.

AGENTS. New Selling Plan! \$1.25 premium free to every customer on a \$2.00 sale, consisting of 8-oz. Vanilla, 6-oz. Shampoo, 4-oz. Lemon Lotion. A big hit everywhere. Complete details free. Territory going fast. Write today. The C. I. Togstad Company, Dept. 19P, 29 South Clinton St., Chicago, Ill.

MR. ADVERTISER: Ask today for a copy of the "Quick-Action Advertising Rate Folder." It contains some really important facts which will prove interesting and valuable to you. It also tells "How You Can Use Popular Science Monthly Profitably." You'd like to know, wouldn't you? Address your inquiry to: Manager, Classified Advertising, Popular Science Monthly, 250 Fourth Ave., New York.

NO dull times selling food. People must eat. Federal distributors make big money; \$3,000 yearly and up. No capital or experience needed; guaranteed sales; unsold goods may be returned. We furnish you with license. Your \$20.00 starting order sent on trust. FREE SAMPLES to customers. Repeat orders sure; Exclusive territory. Ask now! Federal Pure Food Co., L-2311 Archer, Chicago.

WHY work for others? Make and sell your own goods. We show you how. Free book explains everything. National Scientific Laboratories, 1900-A Broad, Richmond, Va.

MANUFACTURE these World's biggest selling specialties. A few dollars will start you making these in your own home, office or shop. You'll have Agents and Specialty Salesmen Selling these for you everywhere. This you easily do with my Guaranteed Superior Manufacturer's Formula and Plain Detailed Instructions for Sapol, Blue Crystal Queen of Soaps; New Way Fabric Mending Fluid; Amazon Self Vulcanizing Rubber Tire Weld Cement; Battery Charging Fluid; Parisian Bobbed Hair Liquid Marcelle; Kings all-color Quick shining Shoe Paste; Ceno-Wonder No Water Hand Paste Soap; Thermoite, Radiator Anti-freeze Crystals; Magic Windshield Cloth; and many other New Unequaled sellers in all lines. Investment small, Quick Returns, Profits Great. State what interests you, enclosing stamp for valuable descriptive literature addressing Miller, Chemist, 1706-Jetton-P, Tampa, Florida.

AGENTS: \$11.80 daily cash (send for sworn proof, Introducing New Insured Hostery. 57 styles, 40 colors guaranteed seven months. No capital or experience required. You simply take orders. We deliver and collect (or you can deliver, suit yourself) Credit given. PAY YOU DAILY, monthly bonus besides. Winter line now ready. We furnish samples. Spare time will do. Macabee Textile Company, Station 15212, Cincinnati, Ohio.

AN UNUSUAL opportunity—Earn \$75.00 weekly and bonus taking orders for Nustile guaranteed Hostery. Sample outfit furnished. Full or spare time. Write now. The Nustile Company, Dept. 4-12, Philadelphia, Pa.

FREE Booklet describes 53 plans for making \$20.00 to \$100.00 weekly in home or office business of your own. Downs Co., 2326 Myrtle, St. Paul, Minn.

NEWEST invention. Sells every office, home, store. Automatically coils telephone and iron coils. Abolishes snarls and kinks. Great time and temper saver. \$25 daily. Samples for test if desired. Neverknot, Dept. 1-9, McClurg Bldg. Chicago.

AGENTS, Salesmen, Executives Can Triple Their Sales Explaining Folder Free. Cutler Company, Reading, Pa.

LIGHTNING storage battery compound. Charges discharged batteries instantly. Eliminates old method entirely. Gallon free to agents. Lightning Co., St. Paul, Minn.

\$50 DAILY Selling Salesboards—Make up to \$33 on single sale selling largest, lowest priced line; no samples to carry, write for 3-color catalogue and full particulars. Lincoln Sales Co., Dept. K, 9 S. Clinton, Chicago.

AGENTS sell Alward's Egyptian Dream Incense for quick sales and big profits. Send for wholesale price list with free sample. Telchert Incense Co., 2402 Bronson Ave., Los Angeles, Calif.

MIRRORS re-silvered at home. Costs less 5 cents per square foot; you charge 75 cents. Immense profits, plating auto parts, reflectors, tableware, stoves. Refinishing metalware, etc. Outfits furnished. Write for information. Sprinkle 96, Marion, Indiana.

FREE: A beautiful 5 tube tuned radio frequency receiver to the first man in each community who answers this ad within 10 days. Write now for particulars. A nationally advertised loud speaker will be sent free every Monday morning for the first letter opened. E. Parker, Putnam St., Peabody, Mass.

EARN \$18 daily selling new automobile product. Experience unnecessary. Free folder explains; get it today. Boone Specialty Co., Dept.-Auto, Boone, Iowa.

SALESMEN attention. Fast selling Fire Extinguisher, \$2.00 commission on each. Sells for \$3.00 Write Lieungh-Fox Company, Iron Mountain, Mich.

MR. ADVERTISER: Ask today for a copy of the "Quick-Action Advertising Rate Folder." It contains some really important facts which will prove interesting and valuable to you. It also tells "How You Can Use Popular Science Monthly Profitably." You'd like to know, wouldn't you? Address your inquiry to: Manager, Classified Advertising, Popular Science Monthly, 250 Fourth Avenue, New York.

SUCCEED With Your Own Products—Make them yourself. Formulas, Processes, Trade-Secrets. Modern master methods. Catalog free. C. Thaxly Co., Washington, D. C.

SALESMEN AND AGENTS WANTED

WANTED—Representatives in every factory in the United States. Popular Science Monthly, 250 Fourth Ave., New York.

\$90 WEEKLY easy with sensational new line of genuine French Lingerie. Prices guaranteed lower than others. Big commissions daily. Outfit and NINE sample garments free to reliable folks. Write Dept. AC-1, Truslik, Inc., New Orleans, La.

AGENTS make \$57 a day driving nails in tire! Amazing discovery heals all punctures—one tire was punctured 357 times without a leak. Send for Free Sample Offer. O. S. Nelson, A-3026 Logan Bldg., Mitchell, S. Dak.

TAKE orders for Shirts and Overalls. Big Profits. Work full or spare time. No experience required. Big variety dress shirts with splendid line Union-made work and flannel shirts, overalls, coveralls, work pants, sheep-lined coats, leather coats and vests. Write today for free selling outfit. The Nimrod Shirt Co., Dept. 25, 4922-24-26-28 Lincoln Ave., Chicago.

DON'T waste time on specialties. We can show you bigger profits, better values and permanent repeat business. \$750 a month is one man's income. No capital or experience needed. Write quick. American Products Co., 5788 American Bldg., Cincinnati, Ohio.

\$20 DAILY selling VER-I-EZY Shoes direct to men in your county. Most comfortable shoes made. Quick sellers. Low priced. Just take orders, we mail shoes direct. Big cash profit and repeats. Best season now. Write quick, Dept. 233, Easy-Wear Shoe Co., Indianapolis, Ind.

WANTED—Representatives in every factory in the United States. Popular Science Monthly, 250 Fourth Ave., New York.

REPLATE brass worn-off automobile parts. Reflectors. Bathroom fixtures, worn spoons, forks, etc., with pure silver. Look like new. Use U-Kan-Plate Polish. Positively no mercury. \$1.00 half pint. Postpaid. Satisfaction guaranteed. Agents wanted. U-Kan-Plate Co., Dept. B, Philadelphia.

TAILORING Agents—Our guaranteed \$21.50 and \$31.50 all wool tailored to order suits are \$10 to \$20 cheaper than store prices. Commission in advance. Protected territory. Beautiful assortment 6 x 9 swatches free. J. B. Simpson, Dept. 1160, 843 Adams, Chicago.

\$20 PROFIT daily selling needlebooks; costs 3-5c each; sells 25c, value 50c. Three samples 25c. Catalogue free. Needlebook Specialty Co., 661 Broadway, New York.

START a business! Our direct-by-mail system is a quick, sure way to sell our \$5000 Accident and Sickness Policy. (Premium \$2-\$24 a year). Same generous commission on new and renewal business. Get territory quick. Address Underwriters, 701 Bonnell Building, Newark, New Jersey.

DO you want a job as an Airplane Salesman? We need representatives to sell our new "Curtiss Racer" airplane motor motor ornament. These airplanes are made from one-piece die castings of aluminum alloy, plated and highly polished and with whirling brass propeller. Special Air Service two-color insignia on upper wings. Fitted with special brackets either for motor motor or ordinary radiator cap. Sample complete with either bracket \$4.00 postpaid. Agents, jobbers, dealers write for particulars. Slipstream Publishing Co., Dept. 2, Dayton, Ohio.

AGENTS—why work for others? Make fastest selling auto supplies yourself; gas tablets, anti-freeze, auto polish, carbon remover, radiator cement, magic windshield compound, tire repairs, etc., etc. Few dollars buys ten secret formulas, complete instructions and all materials. Mixing easy. No special equipment. Enormous profits from start. Write for details. General Motor Supply Co., Box 103, La Crosse, Wis.

AGENTS! Amazing liquid thread darns sox neater, stronger in one-tenth ordinary time. Mends all fabrics invisibly! Stands washing, boiling, ironing. 50c tube, 32c profit. Men sell 100 daily. Make \$3.20 on every \$5. Amazing money maker. Facts free. Write New Way Laboratories, Dept. A-110, Mt. Healthy, Ohio.

SELL "Everyday Greeting Cards." Boxed. 35c commission. Soliciting folder, 10c. Wolfprint, Lawndale, Philadelphia.

BUILD splendid business making chipped glass number and name plates. Particulars free. Simplex Co., Dept. 83, 1133 Broadway, New York.

SELL Lawlite Deflector Shields to motorists, garages, etc. Makes any headlight legal; 100% profit collected as sold. Get details immediately. Lawlite Company, Dept. C, 396 Greenwich Street, New York City.

OVER 110% profit, self-lighting gas and cigar lighters; Everybody interested; repeat business. Sell individuals, dealers, subagents. Particulars free. S. M. Bernhardt, 148 Chambers St., New York.

DISTRICT Agents—For Union Made pure wool suits and topcoats retailing at \$23.50, none higher. A remarkable line of 45 beautiful fabrics tailored by a large and well known old established firm. Sold only thru our own stores and district agents. A real opportunity for any good man. Big money to start and chance for advancement. We furnish large sales outfit, 9 x 13 cloth samples. Men over 30 years of age with tailoring or clothing experience preferred. Can use ambitious spare time men in smaller towns. Interested only in serious men who seek a future. Write for free samples and full information. Address J. D. Harvey, Box 90, Chicago.

MAKE \$150.00 to \$400.00 weekly selling Start Rite Switch for Ford cars. To start car just retard spark lever. No floor button needed. Saves bendix and starter trouble. Demonstrator furnished. Write today for plan and proof of \$1800.00 monthly profit. Dept. 10A-National Sales Co., Inc., Coln, Iowa.

AGENTS—\$100.00 per week and more easy, introducing Chieftain Guaranteed Shirts, 3 for \$4.95. Finest weaves. Latest novelties. Have all competition defeated. Your pay daily in advance. We deliver and collect. Samples free. Cincinnati Shirt Company, Secy. 1601, Cincinnati, Ohio.

GENERAL distributors, agents, salesmen, wanted for quick-selling automobile specialty. Can earn \$75.00 to \$100.00 weekly; permanent business; yields results right from start. Free folder explains. Atkinson Co., Mfrs., Cynthia, Ky.

BRING home the bacon—selling Stuart's Stain Remover. Removes ink, iron rust, grass and fruit stains. Write for free samples and terms today. C. H. Stuart & Co., 5968 Main, Newark, New York.

MR. ADVERTISER: Ask today for a copy of the "Quick-Action Advertising Rate Folder." It contains some really important facts which will prove interesting and valuable to you. It also tells "How You Can Use Popular Science Monthly Profitably." You'd like to know, wouldn't you? Address your inquiry to: Manager, Classified Advertising, Popular Science Monthly, 250 Fourth Ave., New York.

They Thought I Was Bluffing



When I Told Them I Learned Music Without a Teacher

YOU could have heard a pin drop in the room! I had just finished playing Rubinstein's "Melody in F." My friends were actually dumbfounded—they couldn't believe their ears. At last I was the center of attraction instead of a mere onlooker! It was just like a dream come true!

"Why, you didn't know a single thing about music not so long ago, Bob?"—"How in the world did you ever do it?" A note of half envy, half admiration unconsciously crept into their voices after they had recovered from the unexpected surprise which I had just furnished. "Yes," said Jim, "what sort of a trick have you played on us—I thought you weren't musically inclined?" "Oh, he's been taking lessons for years and has kept it a secret"—followed Betty and Sue in rapid-fire succession. "You can't fool us though, you never learned to play that well without a teacher."

"Well, you're all wrong—every one of you," I replied, chuckling with glee. "I'll admit that a short time ago I didn't know one note of music from another. And as far as special talent goes—well, I never had any. And although I had always longed to be able to play the piano it was more or less of an empty dream. For I just couldn't stand the thought of learning music from a teacher and going through a lot of monotonous scales and exercises. It just went against my grain."

"So I've just contented myself with sitting around envying others who could play—watching them have all the fun. Until one night last March I was reading a popular magazine and suddenly an announcement

caught my eye. It told of a new, easy method of quickly learning music—right in your own home—and without a teacher. At first I laughed, like you folks, I thought that such a thing was a joke. Somehow or other I didn't believe it was possible to learn music by mail. But that announcement set me wondering. So I decided that the only sensible thing to do was to investigate. And—well, you know the rest."

From the very beginning I was enthusiastic about my wonderful course in music. Each new lesson was better and easier than the last. Everything about them was so simple that a child of eight could understand it. It was great fun—actually as fascinating as learning a new game. And I always played real notes and catchy tunes. No tricks, puzzles or makeshifts of any kind.

Now I can play any piece of music, whether it's a ballad, jazz or classical number. And I never have to refuse when I'm called upon to entertain. No more lonely nights for me. Now my life is just a joyous round of gay parties and admiring friends.

No matter whether you are a mere beginner or already a good performer, you will be interested in learning about this new and wonderful method.

Send for Our Free Booklet And Demonstration Lesson

In order to make it clear to you—to show you just how and why it gets results twice as fast as any old-time method—we will send to you upon request an interesting free booklet and a valuable demonstration lesson that will make clear the method by which so many thousands have learned. The method is the same for all instruments.

If you are in earnest about wanting to play your favorite instrument—if you really do want to gain the proficiency in music that will add to your happiness, increase your popularity, and open the way to greater income—ask at once for the free booklet and demonstration lesson. Getting them will cost you nothing and place you under no obligation. Right now we are making a Special Offer to a limited number of new students.

Now—before it's too late to gain its benefits—sign and mail the convenient coupon. Instruments supplied when needed, cash or credit. U. S. School of Music, 81 Brunswick Bldg., New York City.



Pick Your Instrument

Piano	'Cello
Organ	Cornet
Violin	Harmony and
Drums and	Composition
Traps	Sight Singing
Banjo	Ukulele
Tenor	Guitar
Banjo	Hawaiian
Saxophone	Steel Guitar
Mandolin	Piccolo
Clarinet	Harp
Flute	Trombone
Voice and Speech Culture	
Automatic Finger Control	
Piano Accordion	

Play Any Instrument

You, too, can now teach yourself to be an accomplished musician—right at home—in half the usual time through this startling method which has already shown 350,000 people how to play their favorite instrument. Forget that old-fashioned idea that you need special "talent." Just read the list of instruments in the panel, decide which one you want to play and the U. S. School will do the rest. And bear in mind no matter which instrument you choose, the cost in each case will be the same—just a few cents a day.

U. S. SCHOOL OF MUSIC,
81 Brunswick Bldg., New York City.

Please send me your free book, "Music Lessons in Your Own Home," with introduction by Dr. Frank Crane, Demonstration Lesson and particulars of your Special Offer. I am interested in the following course:

Have you above instrument?

Name.....
(Please write plainly)

Address.....

City.....State.....

What's Wrong With YOUR English?

"SOMEBODY IS LIABLE TO GET INTO TROUBLE IF THEY KEEP ON ACTING LIKE THEY ARE"



Stop Making Mistakes

They may offend others as much as these offend you

If some one you met for the first time made the mistakes in English shown above, what would you think of him? Would he inspire your respect? Would you be inclined to make a friend of him? Would you care to introduce him to others as a close friend of yours?

These errors are easy for you to see. Perhaps, however, you make other mistakes, which offend other people as much as these would offend you. How do you know that you do not mispronounce certain words; are you always sure that the things you say and write are grammatically perfect? To you they may seem correct, but others may know they are wrong.

Unfortunately, people will not correct you when you make mistakes; all they do is to make a mental reservation about you. "He is ignorant and uncultured," they think. So you really have no way of telling when your English offends others.

FREE Book on English and 15-Minute Test

Sherwin Cody, perhaps the foremost teacher of English in the country, has prepared a simple 15-minute English test which you can take in your own home. This test, with the answers which will also be sent, tells you at once just where you stand. You can discover at a glance whether you make even slight errors. Give yourself this test. If you are efficient in English, it will give you greater confidence; if you are deficient, you surely want to know it, so that you can correct your mistakes.

Mr. Cody's remarkable new invention, the 100% Self-Correcting Method, has already improved the English of more than 41,000 people. No useless rules, no tedious copying, no hard study. Only 15 minutes a day required. You learn by creating the HABIT of using correct English. Nothing like Mr. Cody's method has ever been used before.

You do not want others to judge you unfairly. Write today for this test—it is free. We will also gladly mail you our new free book, "How to Speak and Write Masterly English." Merely mail the coupon or a postal card.

Sherwin Cody School of English
181 Searle Building Rochester, N. Y.

Sherwin Cody School of English
181 Searle Building, Rochester, N. Y.

Please send me your Free Book, "How to Speak and Write Masterly English," and also Mr. Cody's 15-minute Test in English.

Name.....

Address.....

City.....State.....

SALESMEN AND AGENTS WANTED

MAKE \$100 weekly in spare time. Sell what the public wants—long distance radio receiving sets. Two sales weekly pays \$100 profit. No big investment, no canvassing. Sharpe of Colorado made \$955 in one month. Representatives wanted at once. This plan is sweeping the country—write today before your county is gone. Ozarka, Inc., 126 C. Austin Ave., Chicago.

SALESMEN—Earn \$75 to \$250 weekly selling our ALL WOOL made-to-measure suits, \$25 retail. \$4 to \$6 profit on every sale. Six day delivery. United States Fidelity and Guaranty Bond of satisfaction or money refunded. Experience unnecessary. Write today for large free spring samples. Homeland Tailoring Co., Inc., 13 to 27 W. Fayette St., Dept. 100, Baltimore, Maryland.

SELF-THREADING Needles find sales in every home. Fine side line; easily carried; big profits; sample free. Lea Brothers, 147 East 23rd St., New York.

AGENTS: Full or spare time—to sell hand painted scarfs, dollies, pillows. Extremely low priced. A wonderful new process. Our agents are cleaning up. Paintographs practically sell themselves. Write for full particulars of liberal agency offer and circulars describing Paintographs today. Bradford's Paintographs, Inc., St. Joseph, Mich.

ARE you old at forty? See our advertisement on page 130 of this issue. The Electro Thermal Company, 4053 Main, Steubenville, Ohio.

44 MILES on 1 Gallon—Wonderful Vapor Humulifer. All autos. 1 free to introduce. Critchlow, J-120, Wheaton, Ill.

AGENTS: No competition selling spectacles, guaranteed to satisfy, only \$3.98. Pay daily. We deliver collect. Nearly everybody buys. \$10.00—\$25.00 daily easy. True-Fit Optical Co., C.W. 106, 1528 W. Adams St., Chicago.

AGENTS make \$100 week placing advertising Cigar Lighters with glass front. Every dealer wants one. Write for free plan. Drake Mfg. Co., Dept. P., Milwaukee, Wis.

SALESMEN—We furnish you a new Ford car immediately and set you up in business. You own both car and business. No capital required. Profits \$50 to \$150 per week easy. Exclusive territory, city or country. Biggest opportunity ever offered hustlers. Territory going fast. Write quick for details. W. & H. Walker, Inc., Dept. 34, Herr's Island, Pittsburgh, Pa.

ADVERTISING Novelty Pencils and Watch Charms with Frenchy views enlarged 500 times, big seller, 2 samples and list 25c (wholesale, retail) Grandefeld, 1238 Theriot Ave., Bronx, New York.

STAMMERING

ST-TUT-T-T-TERING and stammering cured at home. Instructive booklet free. Walter McDonnell, 59 Arcade, 1126 Granville Avenue, Chicago, Ill.

STAMPS AND COINS

FREE! Price Lists of 3,000 bargains and fine set Bosnia. Penna. Stamp Co., Manor, Pa.

UNITED STATES and Foreign money. Medals. Catalogue and Villa Bill, 10c. Alexis Mengelle, Colorado Springs, Colorado.

FREE! 5 Airmail, 20 unused to Approval Applicants sending 5c. Buckey, 528-P Alameda, Dayton, Ohio.

STAMPS, 100. All different, 3 cents. Lists free. P. S. Quaker Stamp Co., Toledo, Ohio.

1,000 DIFFERENT stamps \$1.00. Fred Onken, 630 79th Street, Brooklyn, N. Y.

OLD Coins. Large Spring Selling catalogue of coins for sale free. Catalogue quoting prices paid for coins, ten cents. William Hesslein, 101B Tremont Street, Boston, Mass.

CALIFORNIA gold \$3/4 size, 27c.; \$3/4 size, 53c. White cent and catalogue, 10c. Norman Schultz, Colorado Springs, Colorado.

STAMPS, 105 China, etc., 2c. Album (500 illustrations) 3c. Bullard, Station AA, Boston.

UNITED STATES—55 different (special issues, etc.); 10c; Borneo Rhinoceros and 105 different, Foreign, Hinges, etc., 10c. Mosley, 4521 Parkview, St. Louis, Mo.

FOREIGN and U. S. stamps 50 all different to approval applicants 10c. W. H. Peck, Penryn, California.

AGENTS wanted to sell stamps received on our big foreign mail. Send 25c for fine selection. Calculator Co., Grand Rapids, Mich.

TYPEWRITERS AND SUPPLIES

TYPEWRITERS: all makes; lowest prices; 5 year guarantee; send for illustrated catalogue. Henry Typewriter Co., 217 West 125 Street, New York, N. Y.

WANTED

DETECTIVES needed everywhere. Experience unnecessary. Particulars free. Write, George Wagner former Government Detective, 1968P Broadway, N. Y.

WANTED—Representatives in every factory in the United States. Popular Science Monthly, 250 Fourth Ave., New York.

\$100 in Cash Prizes

For the best letter of 150 words or less answering the question—"What advertisement in the "Money Making Opportunities" Section interests you most—and why?" First read every advertisement in the "Money Making Opportunities" Section on pages 120 to 150. Pick out the one that interests you most and write a letter—not exceeding 150 words—telling us why you find the advertisement you have selected the most interesting.

See page 5 for last month's prize winning letters and additional information about this contest.

Hawaiian Guitar

FREE to Students

Worth \$18

This Hawaiian Guitar expert and professor wants the opportunity to welcome you as a student so you will quickly learn how to play Hawaiian Guitar—yes, you will be able to play just like the native Hawaiians. To get you started and help your musical success which will bring you popularity, you will receive a beautiful Hawaiian Guitar, the same as the one pictured, free when you enroll. Our short cut method of instruction will enable you to play a piece almost from the first lesson. Rush coupon for full particulars today and we will reserve a gift Hawaiian Guitar for you.



Learn to Play Quickly

With our short cut method of instruction you will quickly learn how to play Hawaiian Guitar which will bring you popularity and social success. You learn to play from notes. If you never had any musical training, you will quickly get on, because our nine experts have perfected a course of home instruction which is as simple as learning A, B, C's.

Picture and Phonograph Record Method Easy

We don't depend upon printed lessons only for your success, but we furnish pictures of our professors playing, diagrams, charts and phonograph records for each lesson. This practically brings our professors from our studio to your own home and enables you to listen to their playing just as if they were actually in front of you. To prove this is easy, we will send you your first lesson free.

Rush Coupon—Send No Money

So positive are we that you will become one of our students, we will send free without obligation, our first lesson. Also receive our free big book which gives particulars about our course. Write for your free book and your free lesson today.

HAWAIIAN STUDIO No. 561
of New York Academy of Music
100 Fifth Avenue, New York, N. Y.

Please rush your free book, "How to Learn Hawaiian Guitar" and my first lesson. Also reserve a gift Hawaiian Guitar for me. This obligates me in no way whatever.

Name.....

Address.....

City.....State.....

FREE To Men Past 40

What is prostate gland disorder? Why does it come to 65% of all men past a certain middle age? Are you a victim? Why does it cause sciatica, aching feet, back and legs, frequent nightly risings? Amazing book written by a well known American Scientist answers all these questions and tells of a wonderful new method that has already given relief to more than 10,000 men—restored the prostate gland to its proper functioning without the use of drugs, electricity or lessons. For a limited time you can get a copy of this book, free, by simply writing a request to the Electro Thermal Co., 4053 Main Street, Steubenville, Ohio, the concern that is distributing this book for the author. No obligation, but write quick for the edition is limited. (Western office, Dept. 40-U, 711 Van Nuys Bldg., Los Angeles, Calif.)

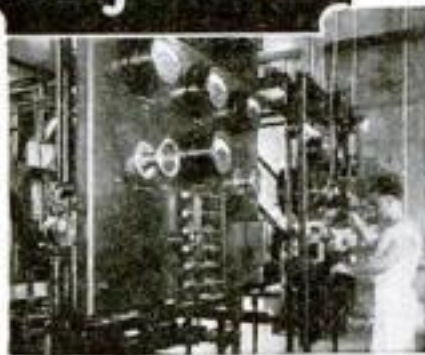


Be a RADIO EXPERT

They Earn \$50. to \$250. a week in Radio—most fascinating work on earth



Learn Quickly And Easily At Home This Practical Way ~ ~ ~ ~ ~



Government Spending Millions on Radio

U. S. Government now spends millions developing, using Radio. Ex-Postmaster General Hays said: "Probably the biggest part in the future of the postal service will be played by Radio." Photo above—sending out time signals at Arlington, great Government Radio station at Washington—Radio is fitting new uses, filling new needs never dreamed of before. Radio Experts are in greater demand than ever.

Send Coupon Now

Get out of the low-pay rut, get into the most fascinating, easiest big-pay profession on earth. Free Book tells you how. ACT AT ONCE—SEND FOR BOOK TODAY.

Train At Home For A Big-Pay RADIO JOB

Radio today is urgently in need of trained men—Radio Experts. Astonishing opportunities—thousands of them—have been opened up by enormous strides of the Radio Industry. That's why it's easy to make big money in Radio—\$50 to \$250 a week. Here's a field that is teeming with opportunities and room for expansion—a brand-new, wide-awake, and uncrowded industry. If you're earning a penny less than \$50 a week, clip coupon now for Free Book and proof.

Your Satisfaction Guaranteed

Master Radio Engineers will show you how to qualify, quickly and easily at home, for Radio's fine jobs. We guarantee to train you successfully. You don't risk a penny, for we will gladly return every cent paid in tuition if upon completion of course you aren't absolutely satisfied. Back of this guarantee stands all the resources of National Radio Institute, U. S. Government-recognized and the oldest and largest Radio home-study school in the world.

Age or Lack of Experience No Drawback

You don't need experience before taking this course and common schooling is enough. Our tested, practical methods make learning clear and easy—the most natural thing on earth.

Famous Course That "Pays For Itself"

Spare time earnings are easiest in Radio-receiving sets everywhere nowadays. In every neighborhood there are scores of jobs you can turn your hand to in an hour or so after supper. Right at the start of your course we give you practical money-making lessons which teach you how to do this work, then how to get it—so by our practical plan you can make your course pay its own way while you're studying.

Get All The Facts At Once

Astonishing facts on the marvelous new industry of golden rewards—Radio—the fastest-moving, live-wire line. Free Book puts all the facts before you. No obligation. Send coupon for it now.

NATIONAL RADIO INSTITUTE
Dept. AT9, Washington, D. C.

Instruments Given With Course

Receiving sets, from simplest kind to thousand mile receiver, included without extra charge in your course. Other apparatus given to help you learn. An UNEQUALLED OFFER. Many other big features for limited time only.

Get This Book

"Rich Rewards in Radio"—most amazing book concerning Radio ever written, will be sent to you promptly when you send the coupon. ACT NOW.



You Can Do What Others Have Done

Why go along at \$15 or \$25 or \$35 a week, when thoroughly-trained Radio Experts earn a hundred or more in the same six days? What this training has done for hundreds of others, it can do for you. Send coupon at once.

Radio Needs Trained Men

N.R.I. TRAINED MEN ARE SUCCEEDING BIG



Operates WMAQ

"Accepted a position with Chicago Daily News—Station WMAQ. My income practically doubled, thanks to your fine course." Keith Kimball, Chicago, Ill.



Gets Big Job

"Just been made Sales Manager of this Radio concern—a big raise in pay. Regret I did not take course sooner." R. E. Jones, Bay City, Mich.

"Your course so completely covers Radio it is worth \$40 a week more to anyone in the electrical line. Since graduation have averaged \$50 to \$80 a week more." Preston Fowler, Gordon, Nebraska.



"The N. R. I. Course has been worth \$2500 a year to me. \$2500 in another year. Thanks a million times to your training." Andrew Shurlo, Latrobe, Pa.



"My charges for consultation now \$2.50 per hour. The course is worth to me at least \$20,000." R. W. Blackhill, Brooklyn, N. Y.



"Your course worth \$2500 a year to me—Radio a gold mine. All my success due to your splendid course." A. R. Herke, Winnipeg, Canada.



MAIL THIS COUPON

NATIONAL RADIO INSTITUTE,
Dept. AT9, Washington, D. C.

Without obligating me in any way, send your Free Book "Rich Rewards in Radio"—also full information on your practical, home-study Radio course.

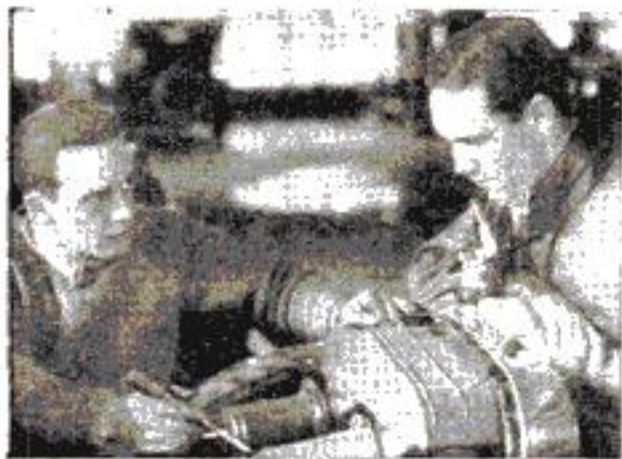
Name

Address

Town..... State.....

LARGEST RADIO SCHOOL IN THE WORLD

ORIGINATORS OF RADIO HOME-STUDY TRAINING



Big Salaries Paid Automobile Experts

Fastest growing industry in U. S. A. offers unusual opportunities to trained men

THE automobile industry is one of the biggest and fastest growing industries in the United States. There are more than 18,000,000 cars registered in this country and the number is increasing every day.

The best way to prepare for success in the automobile field is to study, and there is no better way to do this than through a home-study course with the International Correspondence Schools.

We say this because many of the leading figures in the automobile world today are former I. C. S. students. The list includes Jesse G. Vincent, Vice-President of the Packard Motor Car Co.; Walter P. Chrysler, President of the Chrysler Motor Corporation; E. V. ("Eddie") Rickenbacker; Hiram Walker, Chief Engineer of the Chandler Motor Car Co.; J. V. Whitbeck, President of the Cleveland Automobile Co., and other men equally as famous.

Just mark and mail the coupon and we'll send you information about the I. C. S. Automobile Courses or any other course in which you are interested.

INTERNATIONAL CORRESPONDENCE SCHOOLS Box 7675-D, Scranton, Penna.

Oldest and largest correspondence schools in the world. Without cost or obligation on my part, please tell me how I can qualify for the position or in the subject before which I have marked an X:

- | | |
|--|--|
| <input type="checkbox"/> Complete Automobile Course | <input type="checkbox"/> Gas Engine Operating Course |
| <input type="checkbox"/> Automobile Electric Equipment | <input type="checkbox"/> Complete Gas Engine Course |
| <input type="checkbox"/> Electrical Engineering | <input type="checkbox"/> Architect |
| <input type="checkbox"/> Electric Lighting | <input type="checkbox"/> Architects' Blueprints |
| <input type="checkbox"/> Mechanical Engineer | <input type="checkbox"/> Contractor and Builder |
| <input type="checkbox"/> Mechanical Draftsman | <input type="checkbox"/> Architectural Draftsman |
| <input type="checkbox"/> Machine Shop Practice | <input type="checkbox"/> Concrete Builder |
| <input type="checkbox"/> Railroad Positions | <input type="checkbox"/> Structural Engineer |
| <input type="checkbox"/> Civil Engineer | <input type="checkbox"/> Chemistry |
| <input type="checkbox"/> Surveying and Mapping | <input type="checkbox"/> Pharmacy |
| <input type="checkbox"/> Metallurgy | <input type="checkbox"/> Airplane Engines |
| <input type="checkbox"/> Mining | <input type="checkbox"/> Agriculture and Poultry |
| <input type="checkbox"/> Steam Engineering | <input type="checkbox"/> Mathematics |
| <input type="checkbox"/> Radio | |

BUSINESS TRAINING COURSES

- | | |
|---|---|
| <input type="checkbox"/> Business Management | <input type="checkbox"/> Salesmanship |
| <input type="checkbox"/> Industrial Management | <input type="checkbox"/> Advertising |
| <input type="checkbox"/> Personnel Organization | <input type="checkbox"/> Better Letters |
| <input type="checkbox"/> Traffic Management | <input type="checkbox"/> Show Card Lettering |
| <input type="checkbox"/> Business Law | <input type="checkbox"/> Stenography and Typing |
| <input type="checkbox"/> Banking and Banking Law | <input type="checkbox"/> Business English |
| <input type="checkbox"/> Accountancy (including C.P.A.) | <input type="checkbox"/> Civil Service |
| <input type="checkbox"/> Nicholson Cost Accounting | <input type="checkbox"/> Railway Mail Clerk |
| <input type="checkbox"/> Bookkeeping | <input type="checkbox"/> Common School Subjects |
| <input type="checkbox"/> Private Secretary | <input type="checkbox"/> High School Subjects |
| <input type="checkbox"/> Spanish | <input type="checkbox"/> French |
| <input type="checkbox"/> Illustrating | |

Name.....
Street.....
Address.....
City..... State.....

Occupation.....
If you reside in Canada, send this coupon to the International Correspondence Schools Canadian, Limited, Montreal



Easy to Draw Cartoons

When Shown in the RIGHT WAY

Some of the cleverest cartoonists and comic artists learned how to draw in their spare time by following Cartoonist Evans' Simple and Easy to Learn Method and are now MAKING GOOD MONEY. Send one of your drawings, and let Mr. Evans see if you have ability and receive the Portfolio of Cartoons and full details about the course. It is not expensive.

THE W. L. EVANS SCHOOL OF CARTOONING
825 Leader Building Cleveland, Ohio

Edison, at 79, Still Stalks Nature's Secrets

(Continued from page 15)

"Yes. It is rapidly becoming universal and replacing the old type lead battery."

"Which of your inventions are you completing or perfecting?"

"Phonograph, batteries."

Again we note the economical omission of "and."

Some one told me that the phonograph improvement relates to a method of automatic manufacture of the disks for records. And it is said the batteries are to be adapted for use with self starters for automobiles. This will be almost a revolutionary improvement. The alkaline storage cell lives forever compared with lead-sulphuric acid, but at present it lacks the immediate "kick" needed for a self starter.

"I WAS working on the battery to make it a self starter," said an old employee whom we may call Joe. "Told Mr. Edison it wouldn't work. He came back at me pretty strong. 'Do you understand the theory of electricity, including its mathematics?' 'No, I don't,' said I. 'Only the practical part that I have to do with.' 'Well,' said he, 'you report a big voltage drop. Don't you know the amperes rise when the volts drop, so there is the same wattage? Don't you know that amperes multiplied by volts equal watts? So what's the trouble?'"

If I had been in Joe's place I should have wilted—taken my hat and slipped out of the laboratory as quietly as possible. Joe is a tough guy. He stood by what he knew. He dared remind the half-parent of electricity that wattage is not everything; voltage is pressure and is needed to do a job quick. There was too much internal resistance. More volts wanted. Thereupon Edison scratched his head—a good sign for Joe—and walked away.

I believe the moral of this story is not that Homer nods, but that we should stick to what we know until the cows come home.

To resume that interview, I asked, "On what new lines of research are you now engaged?"

"Many. Wait until I've caught the fish."

My guess is that the biggest fish is a new automobile battery that would last 10 years instead of two. The saving to America on that item would be more than a hundred million dollars a year. And the nickel-iron-alkaline battery gives out no explosive or injurious fumes.

"IF YOU were starting your career now, would you map a different course from that you have followed?"

"No," was the placid reply to an admittedly foolish question.

"What inventions does the world most need to-day?"

"The world doesn't need more just now until general intelligence has increased so men can be had to operate what we have."

Edison was a bit tart in the last answer and seemingly contradictory, too,

(Continued on page 133)

CARPENTERS

Up-to-date inside information in handy form. Practical Guides for Carpenters, Builders, Joiners—and all building Mechanics. Short-cuts, modern methods explained in clear language, pictures, charts, tables and diagrams. All questions answered. Problems solved. A highly endorsed library for Carpenters and Builders. AUDELS CARPENTERS & BUILDERS GUIDES, 4 VOLS. \$6. cover the trade from Use of Tools to Framing Roofs. 1600 Pages—3700 Diagrams, Pocket Size, Flexible Covers, Gold Edges, Ready Reference. Free Trial \$1 a month (satisfied, Send coupon today!)



PLUMBERS

New set—just out! Practical illustrated reference library and study course for Plumbers, Steamfitters, Gas Fitters, Sheet Metal Workers, Draughtsmen, Engineers—all Building Trade Students. An authentic pocket series, covering advancements and short-cuts of Plumbing and Heating Trade. AUDELS PLUMBERS & STEAMFITTERS GUIDES, 4 VOLS. \$6 cover the entire field. Answer your questions, with clear diagrams and concise language. 1670 Pages—3642 Illustrations. Pocket size, Flexible covers. Free examination. \$1 a month (satisfied, Mail coupon NOW!)

MASONS

New, complete reference library and trade course for Bricklayers, Cement Workers, Plasterers, Tile Setters, Stone Masons, with practical outline of Steel Construction. Every masonry question answered clearly so you can understand. An authority on all the Advances, Short-Cuts and Modern Practices. AUDELS MASONS & BUILDERS GUIDES, 4 VOLS. \$6 cover all Mason trades with Answers, Definitions & Diagrams, easy to read and study. 1100 Pages—2067 Illustrations, Pocket size, Flexible covers. Examine books Free! Pay \$1 month. Mail coupon today!

ELECTRICIANS

A simplified Ready Reference and Study Course in practical electricity for professional electricians, engineers and all electricity students. A Handy Helper covering Wiring, Radio, calculations, armatures, maintenance, batteries. AUDELS PRACTICAL ELECTRICITY, 2 VOL. \$4. Covers every subject in one handy leather bound flexible book. 1040 Pages, 2890 Diagrams. Easy to read and learn. Examine Handy Book free! Pay \$1 a month (satisfied, Use this coupon NOW!)

THEO. AUDEL & CO. 65 W. 23 St. New York City
Please mail me for free examination the books marked (x) below. If I find books satisfactory, I will mail \$1 in 7 days on each set ordered and will mail \$1 a month on each set ordered until I have paid purchase price.

FREE EXAMINATION COUPON
☐ CARPENTERS GUIDES -- \$6
☐ MASONS GUIDES -- \$6
☐ PLUMBERS GUIDES -- \$6
☐ ELECTRICIANS HANDY BOOK \$4

Name.....

Address.....

Occupation.....

Employed by..... 1731



Be a Taxidermist Learn by Mail

Learn to mount all kinds of game, birds, animals, fish—tan furs, make rugs, robes, etc. You can now learn this fascinating art in your own home during your spare time. The lessons are interesting and easy to understand. Great sport and lots of fun. Big money for your spare time.

Mount Your Own Specimens

Decorate your home with beautiful specimens that you have caught and mounted yourself. You can make big money doing the work for others. Many specimens are becoming very rare and sell for high prices. Over 75,000 students have learned taxidermy through our lessons. One student writes us: "I have made over \$500.00 during my spare time selling my specimens and mounting for others." We have thousands of similar letters.

FREE Beautifully illustrated book "How to Mount Game". Explains the secrets of taxidermy. Contains dozens of photos of mounted specimens. Every hunter or trapper should have this book. Tells you how you can learn this fascinating art easily and quickly from our school. Send us absolutely free. No obligation. Just send name and address. Write today! Northwestern School of Taxidermy 1781 Elwood Bldg., Omaha, Nebr.

Edison, at 79, Still Stalks Nature's Secrets

(Continued from page 132)

of his own effort to give the world more new things. But I am glad he poked us on our general intelligence. He once told me that man needed to develop about two more twists or convolutions of his gray matter. Also I deduced from that answer that there is a shortage among us of real brainy mechanics and a chance for bright young fellows to qualify as operators of high grade machines.

"How about the American chemical industry versus foreign competition—for example, German synthetic wood alcohol?" I asked.

"American chemical industry is in the making. Germany is still ahead, but not for long."

THE inventor might have added that he himself gave the domestic chemical industry quite a boost during the war, manufacturing benzol, carbolic acid, and a substance that has a name of nine syllables.

"Do you still cut down on sleep, Mr. Edison?"

"No," evidently meaning that the sleep period is now fixed.

"How much do you sleep?"

"Five to six hours. The quality is still perfect."

While ever hostile to sleep, Edison has been wont to lead special campaigns against Morpheus at times when there was a big problem to solve. A member of his famous "insomnia squad" told me about a notable campaign of this sort which took place about a dozen years ago. The problem was to replace the phonograph recording cylinder with a disk of a new, virgin type. For three weeks "the old man" shut himself in the laboratory with a faithful few and never left it, day or night. His food was brought to him: he took catnaps on a cot, totaling perhaps three hours of slumber out of each 24.

At any time he could have been whisked home in a car in five minutes—a fine comfortable home up the hillside in Llewellyn Park—but he had vowed not to leave the scene of action until that enemy problem was licked. His aids were permitted to go home for a little rest, if they liked, after each 36 hours of fighting in the trenches. Overtime pay? Yes. They did get paid in hearing the boss tell endless funny stories of a Chaucerian sort and in working shoulder to shoulder with the greatest human dynamo in the world.

THE boss used to keep a box of good cigars on his desk. He noticed once that they did not last very long and he mentioned that fact to the man who manufactured the brand specially for him.

"I'll tell you what, Mr. Edison. I'll make up some cigars out of rubbish—you keep that box open on your desk for these self-helpers. Keep your own box of good cigars locked in your desk."

So it was done, and shortly afterward the tobacconist asked Edison how the little scheme worked.

(Continued on page 134)

From \$35 a week as a
Garage Hand to
\$5000 a Year
as a
Draftsman

Is He Smarter than YOU?

Do you want a man's size pay envelope? So did this man. Are you a little shy on book learning? This chap never finished eighth grade at school. *But he looked the field over and chose the line nineteen out of twenty Help Wanted ads called for.* He learned the line that's always in demand. He wrote to me in February. *By the middle of May he was a draftsman.* Today, my mail brought his photo and the statement, "I've been made Assistant to the Chief Draftsman at \$400 a month!"

Six Months is ample time for anyone to learn draftsmanship. It's longer than this man studied at home under me! And you need no "talent" for drafting. This student was a garage hand when he started my course! Smart? Yes. Smart enough to pick the liveliest line in all industry.



Train at Home Under My Supervision

—and I'll have you right in the business of drafting—the first hour. There are no books. No theories. We put the tools in your hands, tell you what they're for, illustrate how they're used—and you begin to draft. I will have you so interested inside of a week—and so sure of yourself in a month or two—but you'll have to clip the coupon and get the introductory material to see what a pleasant and profitable course is waiting for you!

You Need Only the Will to Start

We have everything required to put you in the high-pay class—everything but your name and address. If you clip the coupon now and mail it—we'll make the next move—by next mail!

REMEMBER, it's supply and demand that regulates everyone's pay. What good is a machinist if every shop has a waiting list of willing men? What does a head crammed with electricity get you when electrical shops have signs up "NO HELP WANTED"? But every industry is clamoring for draftsmen. (Just check this up in the Want Ad columns of any newspaper.)

JOBS WAITING all over the U. S. Every industry uses blueprints by the thousands, as you know. The biggest concerns recruit their draftsmen from our offices. We haven't students enough to go 'round right now—and next Spring the shortage will be worse. Therefore: to induce action I'll furnish tools without extra charge.

Get the Better Things of Life



Your Own Home
Would you rather have a correspondence school diploma—or a draftsman's salary that will buy a home?



Your Own Car
An "automotive expert" can repair a car—but a draftsman can OWN one.



Leisure
A draftsman has leisure hours and the money to enjoy them!

NOW

about learning. You can become a draftsman, and a good one. I guarantee to train you. If you act in time, I'll furnish all the tools. (You don't need any books; this is a course where you see and do the actual work.) Look into this line that makes work worth while, and life worth living! Coupon brings Successful Draftsmanship book free.

If You Answer This in Time

To the next fifty men enrolling, no extra charge for complete working outfit! Full set of imported nickel silver drawing instruments, a Chief's Own drawing table, rules, squares, supplies—all included! So write at once.

Let Ambition Guide You

—but don't let it run away. There are many, many "schools" that teach most anything. Shoot for the line that is practical—profitable. Get the knowledge every industry needs and is willing to pay for.

Here Is Proof That DRAFTSMANSHIP Leads the Field

There can be no mistake about the field for you. Read below the partial list of 14,282 articles and trades where the draftsman's work comes first:

Aeroplanes and Parts
Agricultural Implements
Armatures
Automobiles
Building
Boats
Bridges
Commutators
Dies, Tools, Jigs, Etc.
Elevators
Engines
Electrical
Furniture
Hardware
Iron and Steel Products
Jewelry
Laboratory Apparatus
Locomotives
Machines (All Kinds)
Nuts, Bolts, Screws
Presses
Railway Equipment
Structural Steel
Store Fronts
Telephones
Tools
Valves
Wagons
Wire Products
Zinc Specialties

So Clip Coupon NOW!

You Suffer If You Wait Mail This COUPON NOW

FREE

CHIEF DRAFTSMAN DOBE

Div. 13-61, 1951 Lawrence Avenue, Chicago, Illinois

WITHOUT OBLIGATING ME send full information about the way you teach practical draftsmanship, your new, enlarged BOOK, and free tool offer.

Name..... Age.....

Address.....

P. O..... State.....



Follow this Man!

Secret Service Operator 38 Is on the Job!

FOLLOW him through all the excitement of his chase of the counterfeit gang. See how a crafty operator works. Telltale finger prints on the lamp stand in the murdered girl's room! The detective's cigarette case is handled by the unsuspecting gangster, and a great mystery is solved. Better than fiction. It's true, every word of it. No obligation. Just send the coupon.

FREE!

The Confidential Reports No. 38 Made to His Chief

And the best part of it all is this. It may open your eyes to the great future for YOU as a highly paid Finger Print Expert. More men are needed right now. This school has taken men just like you and trained them for high official positions. This is the kind of work you would like. Days full of excitement. Big salaries. Rewards.

Can You Meet This Test?

Can you read and write? Are you ambitious? Would you give 30 minutes a day of your spare time preparing yourself for this profession? Would you like a life of excitement, thrilling adventures and high pay? Answer yes and I'll show you how to attain all this.

Send the coupon and I'll send the Free Reports — also a wonderful illustrated book telling of the future awaiting you as a Finger Print Expert.

T. G. COOKE, Pres.

University of Applied Science

1920 Sunnyside Ave., Dept. 13-61, Chicago, Ill.

University of Applied Science

1920 Sunnyside Ave., Dept. 13-61, Chicago, Ill.

Gentlemen:—Without any obligation whatever, send me your new, fully illustrated Free Book on Finger Prints and your special offer of a course in Secret Service Intelligence and the Professional Finger Print Outfit that I can get now at no extra cost.

Name.....

Address.....

Age.....

Edison, at 79, Still Stalks Nature's Secrets

(Continued from page 133)

"Say!" exclaimed the inventor, after scratching his head. "The desk box is empty. Guess I forgot and smoked 'em myself!"

The boss often borrowed tobacco from his laboratory men, I was told, using the same 10-cent brand that they liked. One of them set up a tobacco shop in the laboratory for mutual convenience. Edison patronized it to the extent of two packages a week, but overlooked the detail of payment. The employee couldn't dun the boss for casual dimes. Some one advised him to send a monthly bill to the inventor's secretary. He did, and was promptly paid, then and afterward.

WHILE on this anecdote, I'll include one of the latest going the rounds of the works—which illustrates several things, including the infinite detail that occupies the inventor. At the peak of production the great buildings have housed over 10,000 employees. The story goes that Edison, making his usual rounds, saw a weight on a door on Monday and he sent his usual note, "Weight no darn good. Take it off." It was taken off. On Tuesday he sent another note, "Where is that weight?" It was put on. On Wednesday the boss wrote, "Why hasn't matter been attended to? Weight still there. Why don't you do something about it?" The adjuster of weights took the note to his superior and said: "I can't answer this." The superior said: "Leave it to me," and he sent the following to Edison:

"On again, off again, on again, Finnegan.

Monday, Tuesday, Wednesday.

On Thursday we'll take it off,

Friday we'll put it back,

Saturday have it off again.

But what the—will we do Sunday?"

Doubtless the boss started to scratch his head over this effusion and then had a hearty laugh, for no one likes a joke better. He "razzes" his men and doesn't mind a return. As far as this door yarn is concerned, I wouldn't be surprised if the weight on and off was an experiment; perhaps a psychological test of a dumb-looking janitor.

I ASKED Mr. Edison about his present diet and he replied:

"I eat very little. The amount of power one can get out of a piece of toast is marvelous. What menu? One and one-half glasses milk, tablespoonful cooked oats, one sardine each meal. Weight constant—186 pounds."

This menu is followed for weeks at a time and it includes all meals. The inventor used to weigh himself every day as a check up on his rations, increasing or diminishing food allowance according to the record of the scales.

"What is your present view of college education?"

"Impracticable," was the terse answer.

Every one recalls the Edisonian strafe against colleges a few years ago and how the higher learning was put to a seemingly

(Continued on page 135)

LEARN BY DOING

Every phase of all branches

ELECTRICITY

taught by

Actual Practice

In America's foremost and oldest institution for trade training

No Books Used

Individual Instruction
Start Any Day

Write for FREE 64-page catalog

THE NEW YORK ELECTRICAL SCHOOL

40 West 17th St., New York City

3 DRAFTING Lessons actually sent FREE!

to prove you can learn AT HOME in your spare time!

I have made Drafting so simple to learn, that any fellow with common schooling can now master it quickly and easily at home in spare time! I will send you 3 interesting lessons Free to show you that you can become an Expert Draftsman. At the same time I will tell you all about the wonderful opportunities and big salaries open to Draftsmen. There's a big demand for men who know Drafting from beginning to end, at \$75 to \$125 a week.

OUTFIT GIVEN
Full size, high grade instruments, triangle, T Square, etc.—everything you need—given without one cent extra cost.

Train for Job and Raise
If you're earning less than \$40 a week, go into Drafting. You can learn by my new job-method in a few months. Free Job Service has provided thousands of jobs for both Students and Graduates. Here is your opportunity to get into easy, pleasant work, where you are in line for promotion, and where salaries are BIG.

Send Today! For 3 free lessons, catalog, money-back guarantee, Job Service Information, etc.

Chief Drafting Engineer
AMERICAN SCHOOL, Dept. D-175, Drexel Ave. & 56th St. CHICAGO

BE A JAZZ MUSIC MASTER

Play Piano By Ear

Play popular song hits perfectly. Hum the tune, play it by ear. No teacher—self-instruction. No tedious ding-dong daily practice—just 20 brief, entertaining lessons, easily mastered.

At Home in Your Spare Time
Send for FREE BOOK. Learn many styles of bass and syncopation—trick endings. If 10c (coin or stamp) is enclosed, you also receive wonderful booklet "How to Entertain at Piano"—and many new tricks, stunts, etc.

Niagara School of Music
Dept. 870 Niagara Falls, N. Y.

Send for this Free Book

"STAMMERING"

Its Cause and Cure

You can be quickly cured if you stammer. Send 10 cents, coin or stamp, for 288 page cloth bound book on Stammering and Stuttering. It tells how I cured myself after Stammering and Stuttering for 20 years. BENJAMIN N. BOGUE

7525 Bogue Building, 1147 N. Ill. St. Indianapolis

\$100 in Prizes

See Cash Prize Offer on Page 4 in front advertising section

Edison, at 79, Still Stalks Nature's Secrets

(Continued from page 134)

disgraceful rout under a questionnaire bombardment. That warfare was perhaps embittered by the fact that a number of college graduates were employed in the experimental laboratory. All were suave, hopeful young men, I was told, and when the boss asked them what progress they were making on a problem, they replied that they had just about won. However, on the test, their work usually fell to pieces. This seemed to prove to Edison that colleges merely turned out rank optimists. On the other hand, the self-taught, roughneck members of the laboratory staff were inclined to be more conservative, even pessimistic, on their progress; and when the test came, they often gave Edison a glad surprise.

THE famous questionnaire, comprising hundreds of inquiries on every subject from calculus to cucumbers, has not been used on job applicants for some time. Instead, I believe, the boss gives the applicant a searching visual "once-over." At least he did this the other day to a young chap who was going on the road as a salesman. The young chap said nothing while the boss and his secretary exchanged some shorthand notes; he was just inspected and passed. A while back all employees were disciplined with the questionnaire, save a minority of veteran roughnecks who declined to say whether they had read George Eliot. Nor did these rebels suffer for their attitude.

"Can you give a little advice to young men on how to develop creative talent?" I asked the inventor.

"YOUNG men do not take advice," said Edison gravely, perhaps with a very slight twinkle in his eye. He added: "Creative talent apparently cannot be acquired."

Of course we know that millions of young and old men have taken a lot of Edison's advice and they'll keep doing so for a long time to come. He has fairly forced his advice on the world in voice, song, and light. You bet we take his advice! As for creative talent, hasn't he told us we're all due to grow another loop of that gray matter?

My next query was framed to match the apparent tone of his last response:

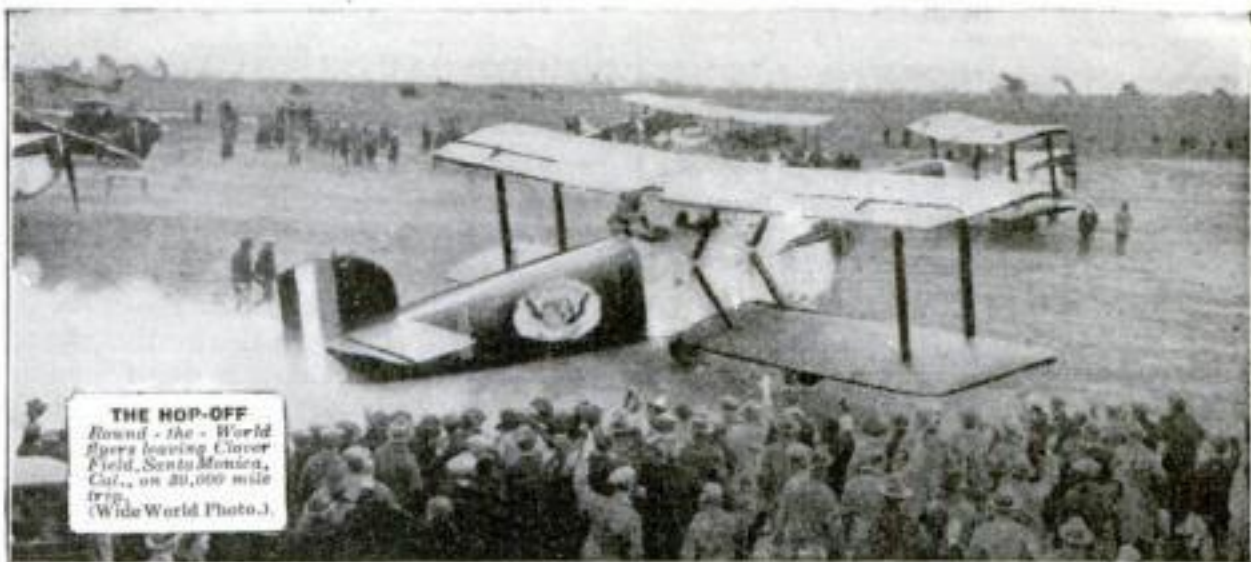
"Has man progressed mentally in the last 50 (or 5000) years?"

A few years ago I believe Edison rapped out a stiff negative to this very question. You can judge whether he is not now mellowed and more hopeful of humanity by this answer:

"Yes. The number of men in every nation, per capita, who are honest, humane, and highly intelligent is increasing. This number is a measure of our civilization. The Lord appears to be in no hurry."

"Will man yet attain a drudgeless world through machines or by tapping the power of sun, tide, or atom?"

"There is no limit to the invention of fully automatic machines," replied Edison. "Man will work less and less."



Daring Young Men Needed in Aviation

THERE is no field of work in the world today which offers such amazing opportunities to young men of daring and who love adventure, as does Aviation. Although still in its infancy, there is a crying demand in Aviation for young men with courage, nerve and self-reliance. For those who can qualify there will be thousands of highly paid jobs which will lead quickly and surely to advancement and success.

Big Opportunities Await the Trained Man

Look over the fields of work which are open to the young man today. You will find that Aviation is the ONE FIELD that is not overcrowded—the ONE FIELD in which there is plenty of room at the top. Think of it! Only 21 years ago Orville and Wilbur Wright made the world's first airplane flight. Now airplanes fly around the world. Yes, Aviation offers the same wonderful opportunities today that the automobile and motion picture industries did 15 and 20 years ago. Men who got in on the ground floor of those industries made fortunes before others woke up. AVIATION IS NEW! It clamors for nifty young men—and the trained man has the world before him in Aviation.

Easy to Become an Aviation Expert—\$50 to \$100 a Week

You can qualify now quickly for one of these exciting, highly paid jobs through a new, sure, easy method of training. The study of Aviation is almost as interesting as the work itself. Every lesson is fascinating and packed full of interest. That's why Aviation is so easy to learn—you don't have to force yourself to study—once you start, you can't get enough of it. Only one hour of spare time a day will give you the basic training in an amazingly short time.

One student, S. F. McNaughton Chicago, says:

"Your lessons are like a romance, and what is more, after one reading, the student gets a thorough understanding. One never tires of reading them." James Powers, Pa., another student, says: "I am indeed surprised that such a valuable course can be had from such practical men for so little cost."

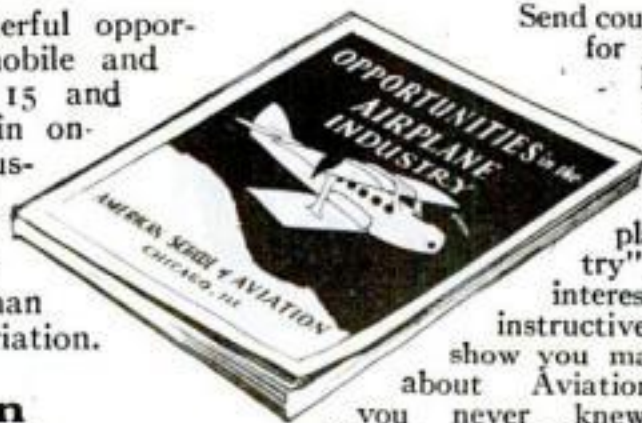
Personal Instruction by Experienced Men

Men who have had actual experience in Aviation give you personal attention and guide you carefully through your training. They select the lessons, lectures, blueprints and bulletins. They tell you the things that are essential to your success. Every lesson is easy to read and quickly understood.

Big Book on Aviation FREE

PREPARE For One of These POSITIONS

Aeronautical Instructor \$60 to \$150 per week
Aeronautical Engineer \$100 to \$300 per week
Aeronautical Contractor Enormous profits
Aeroplane Repairman \$60 to \$75 per week
Aeroplane Mechanician \$40 to \$65 per week
Aeroplane Inspector \$50 to \$70 per week
Aeroplane Salesman \$5000 per year and up
Aeroplane Assembler \$40 to \$65 per week
Aeroplane Builder \$75 to \$200 per week



Send coupon below for New Free Book, just out, "Opportunities in the Airplane Industry"

It is interesting and instructive and will show you many things about Aviation which you never knew before. Only a limited number offered—get yours before the edition is exhausted.

AMERICAN SCHOOL OF AVIATION
Dept. 1361, 3601 Michigan Ave., Chicago, Ill.

AMERICAN SCHOOL OF AVIATION,
3601 Michigan Ave., Dept. 1361,
Chicago, Ill.
Without any obligation, send me your Free Book, "Opportunities in the Airplane Industry," also information about your Course in Practical Aeronautics.
Name.....
Street.....
City.....State.....

MEN WANTED

Do you want money? Do you want independence? Do you want a sure trade that pays \$50 a week up? Do you want to travel and see the world? How would you like a good driving job? Or a place in a repair shop? Or your own service or tire or battery station?

If you are willing to work for a few weeks you can absolutely promise yourself to make your dream come true. You don't need experience; you don't need education. The Famous Sweeney System of Practical Instruction is taught only at the Sweeney School, Kansas City, Mo.



Big Special Offer!

Jobs Open

Demonstrator, \$150 to \$500
Garage, \$150 to \$400
Tractor, \$10 a day
Electrician, \$225
Mechanic, \$6 to \$10 a day
Chauffeurs, \$90 to \$150
Truck Drivers, \$125
Tire, \$100 to \$200
Welder, \$140 to \$200
Battery, \$150 to \$200

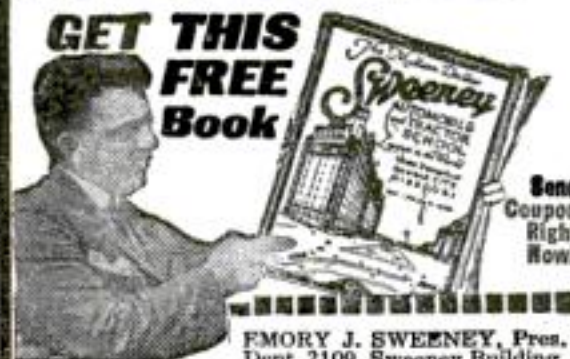
If You're Mechanically Inclined here is your opportunity. There is a fine job ready for you. I refer you to over 60,000 Sweeney-trained men from farms and small towns who have made good. 17 million automobiles in U. S. In my million dollar auto school I train you for high paid jobs in a few weeks. Remember, my amazing offer right now means a lot to you—but you must act quick.

FREE

Simply send name today or clip coupon for my 64-page illustrated catalog. Tells in interesting way about opportunities in auto business and shows how we train men by actual experience, working with their hands instead of learning from books. Come and look at the world's biggest and most popular trade school. See how the men like the World Famous Sweeney System. Get the facts about how easy it is now to make big money doing work you like. Be independent. Travel. See the world. Own your own garage, tire shop, battery station. Take the first step now by sending for this big free book. Special Radio Course free to all who enroll in the next sixty days. No colored students accepted. Remember, this is the most amazing offer I have ever made in the history of this school.

LEARN A TRADE—
Sweeney
AUTOMOTIVE & ELECTRICAL SCHOOL
2109 SWEENEY BLDG. KANSAS CITY, MO.

GET THIS
FREE
Book



EMORY J. SWEENEY, Pres.
Dept. 2109 Sweeney Building,
Kansas City, Mo.

Send Free Catalog and Special Offer.

Name

P.O.

State

Snakes Are Safe if You Know how to Pet Them

(Continued from page 21)

"That fat three-footer with the beautiful circular design on his flanks is an urutú. He's an irritable little cuss. Watch!"

Joaquim poked at the snake with his stick, and the reptile instantly struck blindly right and left, without coiling. "He thinks he's a machine gun," said Joaquim. "He strikes so often and so fast that he doesn't bother to take aim. The law of chance is in his favor. The urutú is abundant, and he cripples when he doesn't kill. One of his victims was brought here for treatment. She was totally blind, vomiting blood, shaking with chill, and barely conscious. She had been bitten less than an hour before. You would have said she was already past hope. It took two injections of serum and two days of care to cure her.

"THE boipeva, which also strikes from flat on the ground, without coiling, and the white-tailed jararaca that you see over there, are close relatives of the others I've mentioned, but aren't so common nor dangerous. Your moccasins and copperheads in the United States are allied to these species.

"Now here we come to Mr. Cascavel, the *Crotalus terrificus*, the boicininga—in a word, the good old always-unreliable rattler. We have only one species of rattler in Brazil, compared with the dozen or so that you have in the United States—but our one is quite enough. His venom is five times more active than any other we have studied. He is common and savage; slow to act, it is true, but deadly sure. Our kind friends on the fazendas, or farms, send us as many as two thousand living specimens a year.

"A victim of the rattler should receive serum treatment within two hours, to be safe, and should be watched for as much as three weeks, during which period the dangerous symptoms may crop out again even after an apparent cure.

"There are about 500 known species of poisonous snakes in the world. The rattlers and moccasins and these Brazilian snakes I've shown you are closely related. All have fangs with a hollow tube through which the venom flows. But we have quite another kind of snake in Brazil—those gorgeous little coral snakes that you see over there. They are related to India's devastating cobra. You can see the similarity in shape—long, thin, and graceful, and if you cared to examine their teeth, you would find that their fangs have only a trough, or partially open canal, through which the poison flows, instead of a wholly inclosed tube as in the case of the other snakes you've seen."

I TOLD Joaquim I'd take his word for it about the fangs; but I couldn't help admiring again, just as I often have in the jungles, those dainty little coral snakes, with their brilliant bands of red, black, yellow and white. They are deadly in the extreme—but fortunately their coloring, like a gaudy bead necklace, makes them conspicuous.

Next Joaquim pointed out a long, grace-

(Continued on page 137)

Music Lessons

WITH AN ACCREDITED SCHOOL

At Home

A Complete Conservatory Course By Mail

Wonderful home study music lessons under great American and European teachers. Endorsed by Paderewski. Master teachers guide and coach you. Lessons a marvel of simplicity and completeness.

The only recognized Conservatory of Music giving lessons by the UNIVERSITY EXTENSION METHOD.

The ideal of a genuine Conservatory of Music for home study based upon lessons containing the cream of the life's teaching experience of Master Musicians, reinforced by the individual instruction of specialists, is now attained.

The instruction of a master—the individual touch of an accomplished teacher—is yours to command from the very moment you enroll.

The University Extension Conservatory, by adopting the Personal Instruction Method, has placed home music study beyond question as to results. Anyone can learn at home.

Any Instrument Write telling us course you are interested in—Piano, Harmony, Voice, Public School Music, Violin, Cornet, Mandolin, Guitar, Banjo, or Reed Organ—and we will send our Free Catalog with details of course you want. Send now.

UNIVERSITY EXTENSION CONSERVATORY
235 Siegel-Myers Building Chicago, Illinois

ELECTRICITY

My first job after leaving school took 2 hours and I received \$65.00 for the inspection. I worked up to over \$600.00 a month and expect to clear \$10,000 the first year.
Paul A. Carson.

You Learn by Doing
No matter what your education or age, you'll find a place at S. O. E. and a course to meet your needs. 3 months D.C. and A.C. armature winding, auto electricity or radio courses fit you for fast advancement. Learn practical electricity in 6 months; junior electrical engineering, commercial electrical engineering or electro-technician in 12 months. Electrical Engineering 3 years. Step in the line of success. Send for FREE ILLUSTRATED CATALOG TODAY.

SCHOOL of ENGINEERING of Milwaukee
Dept. P5126—415 Marshall St., Milwaukee, Wis.

Big Demand—Big Pay Be a Plumber

We Train You Quick Learn To Do Any Job—Step right into a Big Pay Job or Start a Shop of Your Own. Work the year around—Earn more in one day than some folks do in a week. Why serve 4 years Apprenticeship? **LEARN in 8 to 12 WEEKS—REAL PLUMBERS TEACH YOU.** Learn All Branches including lead wiping, plan work, etc. Strictly tool using system. No books used. The Plumber Modernizes the Home and Turns Drudgery into Pleasure. Field growing daily. Don't envy a Plumber—Be One. Write for information—Special Tuition Fee and Amazing opportunities. Don't delay—Do it Today.

KANSAS CITY SCHOOL OF PLUMBING
2031 Troost Ave. Kansas City, Mo.

LAW Free Book

Write today for FREE 128-page book, "THE LAW TRAINED MAN," which shows how to learn law in your spare time and earn more money. Qualify for a high salaried executive position or prepare to enter the practice of law. Study at home through the Blackstone Course prepared by 80 prominent legal authorities including CHIEF JUSTICE WILLIAM HOWARD TAFT. Blackstone graduates practicing law everywhere. J.L.B. degree conferred. Magnificent 25 volume law library furnished immediately upon enrollment. Moderate tuition fee. Low monthly terms. Money Back Guarantee. Write for book today. 4753 Grand Blvd. Blackstone Institute, Inc., Dept. 121 Chicago
America's Foremost Non-Resident Law School

LAW STUDY AT HOME

Become a lawyer. Legally trained men win high positions and big success in business and public life. Be independent. Greater opportunities now than ever before. Big corporations are headed by men with legal training. Law trained men earn \$5,000 to \$10,000 Annually. We guide you step by step. You can train at home during spare time. Degree of LL.B. conferred. LaSalle students found among practicing attorneys of every state. We furnish all text material, including fourteen-volume Law Library. Low cost, easy terms. Get our valuable 128-page "Law Guide" and "Evidence" books free. Send for them NOW.

LaSalle Extension University, Dept. 183-4 Chicago
The World's Largest Business Training Institution

A SERVICE FOR YOU
In Buying Radio & Tool Equipment
For list of tested and approved products write to the Popular Science Institute of Standards. See Page 6.

Snakes Are Safe if You Know how to Pet Them

(Continued from page 136)

ful serpent, bluish black in color. "A mussurana," he said. "He is non-venomous himself, and he delights in eating venomous snakes. In five years this one has eaten 112 rattlers and jararacas, some of them bigger than himself.

"Oh, for a long time, we had great hopes of that fellow. We were going to breed him, and scatter his kind all over the fazendas, to slay the other snakes. He is one of the few living things that is immune to the bites of poisonous serpents.

"I'VE seen a mussurana crawl up to a jararaca and unconcernedly twine himself around the latter's body, even though pricked by the poison fangs several times during the struggle. Slowly the mussurana would wrap the larger snake in tightening coils, and finally would get hold of his enemy's neck. The latter would hardly even fight—he was relying on his venom to weaken his adversary shortly, as in all his past experience it had always done. But when once his neck was gripped in the mussurana's jaws, the battle was over, and the mussurana was soon absorbing as much of the jararaca as he could hold.

"Apparently there is only one snake whose poison is deadly to the mussurana, and that is the pestiferous little coral.

"But our scheme of breeding mussuranas as protectors of the fazendas hasn't worked. We receive very few specimens, and we can't keep many of them alive in captivity. For a time we flirted with the idea of using wild hogs to fight snakes. They too are nearly immune to venom, but for a different reason. It is simply that they carry so much fat that the poison rarely gets through it to a vital spot. And they like to eat snakes. But the planters won't have them around, for they destroy crops as well as serpents. Now we have another white hope in the national offensive against serpents. It is this little Brazilian skunk, which seems to be a natural born snake slayer. I'll show you."

THE skunk was put into an inclosure with a cascavel. He approached the rattler, sniffed it, and was promptly bitten three times. We could see the blood from one bite on his nose, and even a trickle of the over-abundant venom. The skunk meditatively raised a paw and wiped the injured nose—then decided he was hungry. So without more ado, he simply bit off the rattler's head and ate it with relish, poison glands and all.

"He won't suffer a bit from that poison," said my guide. "Yet any one of those three bites would have slain you. The skunk is blessed with immunity—and I don't think science really knows what that is. Each snake is relatively immune to the bites of others of the same species. The amount of rattler venom necessary to kill another rattler, will kill 10 snakes of other species, 24 dogs, 60 horses, 600 rabbits. I don't know how much venom would be necessary to kill one of these

(Continued on page 138)

FASCINATING



... and perhaps you, like other ambitious men, due to the lack of money, time and education necessary to master difficult mechanical trades, wonder what you can get into quickly and make the most out of, now! Haven't you overlooked the very thing you are looking for?

For there is a profession begging for clean-cut, earnest men, like yourself! Look into it! 60,000 Moler graduates know Modern Barbering is easy to learn, inexpensive, quicker to earn, clean and FASCINATING! It pays better than you think! FIND OUT! Write for booklet C.

Address the branch of the **MOLER SYSTEM OF COLLEGES** nearest you
(Street address not needed)

Chicago, Ill.	Detroit, Mich.	Memphis, Tenn.	Los Angeles, Calif.
New York, N. Y.	Denver, Colo.	Dallas, Tex.	Salt Lake City, Utah
St. Louis, Mo.	New Orleans, La.	Houston, Tex.	San Francisco, Calif.
Kansas City, Mo.	Omaha, Nebr.	San Antonio, Tex.	Tacoma, Wash.
Cincinnati, Ohio	Milwaukee, Wisc.	Minneapolis, Minn.	Portland, Ore.
Cleveland, Ohio	Atlanta, Ga.	Seattle, Wash.	Winnipeg, Man., Can.
Fargo, N. D.			

Make More Money

Read the Money Making Opportunities on pages 120 to 150 of this issue.



WANT \$2700 A YEAR?

Become Railway Mail Clerks

ALL POSTAL SALARIES JUST RAISED
MAIL COUPON BEFORE YOU LOSE IT

Steady Work—No Layoffs—Paid Vacations
Travel—See Your Country
Common Education Sufficient

Franklin Institute, Dept. K298, Rochester, N. Y.
Sir: Send me without charge, (1) sample Railway Postal Clerk Examination questions; (2) tell me how to get a U. S. Government job; (3) send list of places at which examinations will be held and free sample coaching.

Name.....
Address.....

\$100 for One Good Commercial Drawing



Become An Artist This Easy Way

Thousands who never dreamed they could draw can now easily become artists. You too—without any previous training—and no matter how little apparent talent you have—can now easily learn Illustrating, Designing and Cartooning through this amazingly easy method.

You learn at home yet your work receives the personal attention and criticism of one of America's most successful artists. Many students actually sell enough work during their training to pay for it many times over.

Big Money in Commercial Art

Millions of dollars are being spent this year on advertising and story illustrations, commercial designs, and cartoons. And even more will be spent this year. Commercial art is a tremendous field—and a field where very big money is gladly paid anyone who can produce good art work. Advertisers, magazines, newspapers, printing houses, business concerns all need trained artists. Competent artists easily earn from \$50 to far over \$300 a week. And now you can easily enter this "world's most fascinating, best paid business."

Mail Coupon for Free Book

A new handsomely illustrated book has just been printed, which gives all the most up-to-date information on the thousands of wonderful opportunities in Commercial Art and shows how this startling short cut method easily enables you to enter this field. It tells about our students—their success—what they say—actual reproductions of their work—how they made big money while studying. This attractive book will be sent without cost or obligation. Send for it. Mail coupon now.

Washington School of Art, Room 241-D
1115-15th St., N. W., Washington, D. C.

WASHINGTON SCHOOL OF ART,
Room 241-D, 1115-15th St., N. W., Washington, D. C.

Please send me without cost or obligation your new book on art, "Quick Easy Way to Become an Artist," and details of your special offer.

Name.....
Please write plainly Mr., Mrs. or Miss

Address.....

City.....State.....

Snakes Are Safe if You Know How to Pet Them

(Continued from page 137)

skunks. We hope that ultimately they may prove to be a valuable ally in the war against snakes.

"But today the only real hope is the serum. The way we make it is fairly simple. The venom is extracted by holding a snake and forcing him to strike with his fangs on a glass vial, which receives about half a teaspoonful of the poison. This is diluted and otherwise treated, and then injected into the horses that we keep for the purpose. Doses growing gradually stronger are given repeatedly for about six months. By that time the horse's blood has developed an extraordinary resistance to the poison. We draw off then about six quarts of his blood and from this the serum is made.

"INJECTED into any snake-bite victim, this serum apparently neutralizes the effect of the poison until the victim's own glandular system has time to rise to the emergency and conquer the poison.

"You often have read of many methods supposed to cure snake bite. Making a ligature, sucking out the venom, taking brandy and cathartics, and keeping the puncture open with a packing of sterile gauze all are recommended. Down here, from repeated experiment, we are convinced that all the familiar recipes are quite futile. The snake venom fixes itself on the nerves, in the tissues and blood, with devastating rapidity. Once you are bitten, it is too late for any cure except serum.

"All reported cases of cures by these other methods mean merely that the snake was not a poisonous species, or else that his fangs did not administer a normally fatal dose.

"Our daily association with snakes here has upset a whole raft of superstitions. Snakes will not pursue you. They will not attack you unless disturbed. They cannot leap through the air, as our natives firmly believe. They cannot hypnotize anything. We have repeatedly tested on birds, rats, and toads this widely credited hypnotic power of snakes, and we know they have no such power.

"ANOTHER superstition has grown up around the snake's forked tongue. Not only our natives, but many educated people think that that flashing pink tongue is a poisonous sting. As a matter of fact, it is nothing but a feeler, and is utterly harmless. The two fangs, which fold back when the mouth is closed, and spring down into striking position when it is open, are the only weapons the snake has.

"Here, help me hold this rattler a minute, and I'll show you—" There Joaquim went again, picking up snakes! I'd had enough. I told him that I must go to keep an engagement with wild Indians in the jungle.

I've learned today that you are perfectly safe with snakes if you have plenty of serum, and wear leggings and gloves, and know how to handle the reptiles. But I rather suspect that you can be still safer by not handling them at all.

AUDELS ENGINEERS' MECHANICS' GUIDES

Practical educators for all Engineers, Firemen, Machinists, Electricians and engineer students. Eight valuable, up-to-date Guides treating on the theory and practice of modern Engineering in all its branches.



A COMPLETE HOME STUDY COURSE AND REFERENCE LIBRARY

8 pocket numbers with Ready Reference Index. 8754 pages. 4750 illustrations. Easy to read. Highly endorsed. A good help in securing Engineer's License. Price \$12; terms, \$1 per month. Free Trial.

INFORMATION: — In A Handy Form. Answers to Your Questions and Problems. Here is a partial list of the subjects covered:— Engine Principles, Valve Setting, Pumps, Corliss Engines, Uniflow Engines, Pumping Engines, Contractors Engines, Locomotives, Marine Engines, Turbine Engines, Gas Engines, Oil Engines, Indicators, Producers, Aviation, Steam, Fuel Economy, Boiler Construction, Firing, Oil Burners, Stokers, Boiler Repairs, Pipe Fitting, Heating, Refrigeration, Elevators, Dynamos, Motors, Lighting, Wiring, Electrical Diagrams, Radio, Electrical Reference and Calculations.

SHIPPED FREE

Not a cent to pay until you see the books. No obligation to buy unless you are satisfied. Fill in coupon in pencil. Send now—today—get this standard library for Engineers and Mechanics.

FREE EXAMINATION COUPON
Theo. Audel & Co., 65 W. 23 St. N.Y. City
Send me AUDELS ENGINEERS' AND MECHANICS' GUIDES. 8 numbers, \$12. for free examination. If satisfactory, I will send you \$1 in 7 days, then \$1 monthly until \$12 is paid.

Name.....

Address.....

Occupation.....

Employed by..... I T 34

Your Choice
\$20.00
Musical Instruments
FREE To Our Students

Your choice of a Violin, Tenor Banjo, Hawaiian Guitar, Banjo, Cornet, Ukulele, Banjo Ukulele, Guitar, Mandolin or Banjo Mandolin. You will be proud to own any one of these instruments and you can have one absolutely free. A few cents a day for lessons is your only expense. Our system of teaching is so easy that you can play several pieces by note with the first four lessons. We guarantee success or no charge. Instrument and lessons sent on one week's free trial. Write for booklet today, no obligation.

CHICAGO CORRESPONDENCE SCHOOL OF MUSIC
Orchard and Willow Streets, Dept. 30, Chicago, Illinois

Anyone CAN LEARN!

No talent or experience necessary. Fascinating work. Pays big money. Complete instruction book TELLS ABOUT: Alphabets, Colors, HOW TO MIX PAINTS, Show Cards, Window Board and Wall Signs, Ready made letters, Gliding, TRUCKS OF THE TRADE, also 100 Alphabets and Designs. Book bound in flexible int. leather, gold edges, and four ball bearing Show Card Pens. Book and Pens sent postpaid for \$3.00. (C. O. D. 10c extra.) Ogilvie Pub. Co., 57 Rose St., Dept. 72, New York

EARN MONEY IMMEDIATELY—WE FURNISH EQUIPMENT TO START

MY PATENT
LAW OFFICESJUST ACROSS
STREET FROM
U.S. PAT. OFF.

PATENTS

INVENTORS
Write for these
FREE BOOKS!

At the left is a view of my drafting and specification offices where a large staff of experienced experts are in my constant employ. All drawings and specifications are prepared under my personal supervision.

PROTECT YOUR IDEAS

Take the First Step Today—**ACTION COUNTS**

If you have a useful, practical, novel idea for any new article or for an improvement on an old one, you should communicate with a competent Registered Patent Attorney AT ONCE. Every year thousands of applications for patents are filed in the U. S. Patent Office. Frequently two or more applications are made for the same or substantially the same idea (even though the inventors may live in different sections of the country and be entirely unknown to one another). In such a case, the burden of proof rests upon the last application filed. Delays of even a few days in filing the application sometimes mean the loss of a patent. So lose no time. Get in touch with me at once by mailing the coupon below.

No Charge for Information on How to Proceed

The books shown here contain valuable information relating to patent procedure that every inventor should have. And with them I will also send you my "Record of Invention" form, on which you can sketch your idea and establish its date before a witness. Such evidence may later prove valuable to you. Simply mail the coupon and I will send you the books, and the "Record of Invention" form, together with detailed information on how to proceed and the costs involved. Do this NOW. No need to lose a minute's time. The coupon will bring you complete information entirely without charge or obligation.

Prompt—Careful Efficient Service

This large, experienced organization devotes its entire time and attention to patent and trademark cases. Our offices are directly across the street from the U. S. Patent Office. We understand the technicalities of patent law. We know the rules and requirements of the Patent Office. We can proceed in the quickest, safest and best ways in preparing an application for a patent covering your idea. Our success has been built on the strength of careful, efficient, satisfactory service to inventors and trademark owners located in every state in the Union.

Clarence A. O'Brien

Registered Patent Attorney

Member of Bar of: Supreme Court of the United States; Court of Appeals, District of Columbia; Supreme Court, District of Columbia; United States Court of Claims

Practice confined exclusively to Patents, Trademarks and Copyrights

Strict Secrecy Preserved Write Me in Confidence

All communications, sketches, drawings, etc., are held in strictest confidence in strong, steel, fireproof files, which are accessible only to authorized members of my staff. Feel free to write me fully and frankly. Your case will have my personal attention. It is probable that I can help you. Highest references. But FIRST—clip the coupon and get my free books. Do THAT right now.

**Mail this Coupon NOW.****CLARENCE A. O'BRIEN**

Registered Patent Attorney,
5395 Security Saving & Commercial Bank Bldg.,
Washington, D. C.

Pleased send me your free books, "How to Obtain a Patent," and "Invention and Industry," together with your "Record of Invention" form without any cost or obligation on my part.

Name

Address

(Important: Write or Print name clearly)

PATENTS

TRADE-MARKS
DESIGNS
FOREIGN PATENTS

MUNN & CO.
PATENT ATTORNEYS

Associated since 1846 with the Scientific American

683 WOOLWORTH BUILDING
New York City

1311 TOWER BUILDING
Chicago, Ill.

522 SCIENTIFIC AMERICAN BLDG.
Washington, D. C.

664 HOBART BUILDING
San Francisco, Cal.

519 VAN NUYS BUILDING
Los Angeles, Cal.

Books and Information on Patents
and Trade Marks By Request.
Associates in All Foreign Countries.

Lessons in Magic

(Continued from page 18)

Do this a few times when all six papers are attached. Then, when you remove one, raise the knife, apparently as before, but as the point comes up, push your thumb slightly in the direction of the point of your forefinger. This will give the knife a half turn that will not be detected, but will let the audience see only the side of the blade that was visible when the knife was held in the lowered position.

When you bring the knife down, of course, you pull your thumb in the opposite direction so that the half turn is reversed. With a little practice you should be able to show either side of the knife at will.

ANOTHER little "table trick": Take a lump of sugar from a bowl, roll it out on the table and challenge any of your companions to set it on fire. When several of them have held matches to it unsuccessfully, you take it, or another lump, hold a match to it, and immediately the sugar begins to burn.

The trick here lies in applying a tiny speck of tobacco ash to the sugar. You may do this either by letting the lump of sugar carelessly fall to the table or to a plate where you have placed a speck of ash, or by rubbing a little ash against the sugar with the end of your finger. The smallest bit is sufficient to start the sugar burning when you apply the match, for the ash and the sugar form a fusible chemical compound.

This is as far as I would advise any amateur to go in performing chemical tricks, for such tricks may cause serious accident and injury to a person who has not a thorough knowledge of chemicals and their effects. I have just received a letter from the sister of an amateur magician telling me that her brother had blown off one of his arms while mixing a flash powder of phosphorus and potash, and asking me to warn others against playing with powerful and dangerous chemical combinations.

THERE are a number of pretty and amusing effects to be obtained by folding and tearing paper. One of the best of these is what is called a "Jacob's Ladder." Fold the short edge of a sheet of newspaper to form a little "hem" of about half an inch. Roll the sheet down its length loosely into a cylinder about 1½ inches in diameter. When six or eight inches from the end of the roll, insert another sheet of newspaper and continue rolling.

Continue this process until your roll consists of 10 or a dozen sheets, or more, if experiment shows you that you can handle them. Be sure, though, not to make the roll too tight.

When you have completed the cylinder, flatten it down and tear out a piece as shown in the drawing on page 18. Fold down the ends as shown, flattening the center piece and smoothing all wrinkles out of the two ends. Take hold of the little hem in the center of one of the cylindrical ends and pull. Alternately pulling on the hem in each cylinder, draw out the "ladder" to its full length.

(Continued on page 141)

PATENTS

To the Man With an Idea

I offer a most comprehensive, experienced, efficient service for his prompt, legal protection and the development of his proposition.

Send sketch, or model and description, for advice as to cost, search through prior United States patents, etc. Preliminary advice gladly furnished without charge.

My experience and familiarity with various arts, frequently enable me to accurately advise clients as to probable patentability before they go to any expense.

Booklet of valuable information and form for properly disclosing your idea, free on request. Write today.

RICHARD B. OWEN
Patent Lawyer
6 Owen Building, Washington, D. C.
41-D, Park Row New York City

TRADE-MARKS

REGISTERED

U.S. PATENTS

SEND FOR THIS FORM

DON'T LOSE YOUR RIGHTS TO PATENT PROTECTION

Before disclosing your invention to anyone send for blank form "EVIDENCE OF CONCEPTION" to be signed and witnessed. A sample form together with printed instructions will show you just how to work up your evidence and establish the same before filing application for patent. As registered patent attorneys we represent hundreds of inventors all over the United States and Canada in the advancement of inventions. Our schedule of fees will be found reasonable. The form "Evidence of Conception," sample, instructions relating to obtaining of patents and schedule of fees sent upon request. Ask for them,—a post card will do.

PATENTS AND TRADE MARKS
LANCASTER & ALLWINE
Registered Patent Attorneys in U. S. and Canada
274 Ouray Bldg.
WASHINGTON, D. C.
Originators of forms "Evidence of Conception."

INVENTORS PROTECT YOUR IDEAS

Send for our Guide Book, **HOW TO GET A PATENT**, and Evidence of Invention Blank, sent Free on request. Tells our terms, methods, etc. Send model or sketch and description of your invention for **Inspection and Instructions Free**. Terms Reasonable. Best References.

RANDOLPH & CO.
Dept. 130, Washington, D. C.

NAME.....
STREET.....
CITY.....STATE.....

Lessons in Magic

(Continued from page 140)

If performing this effect unaided, it may help you if you put rubber bands about the cylindrical ends to prevent them from unrolling. Or you may ask some one to hold the ends for you, and then pull out the "ladder" by taking the hem in each cylinder in your fingers and backing away.

THE ladder, of course, need not be made with newspaper. You can use rectangular sheets of almost any size—pages from a magazine, typewriting paper, colored paper; whatever happens to be at hand. The greater the number of sheets, of course, the longer the ladder; the limit is determined only by the number your fingers are strong enough to tear.

These tricks, although more or less elementary, are, every one of them, most effective if artistically performed. Remember that misdirection is the secret of every magical illusion. Divert the attention of your audience from what you are doing, particularly at the critical moment in your trick. A most effective aid in bringing this about is bright patter, so, if you are to succeed as an amateur magician, you must acquire the ability to talk rapidly, continuously, and interestingly.

Self confidence to the point of brazenness is another attribute that the successful magician must have. You can never put over an illusion if you attempt to do so in a timid, bashful manner. And self confidence will come only from the consciousness of skill, won by patient, ceaseless practice.

From the Editor's Mail

WHY do you read POPULAR SCIENCE MONTHLY? What articles interest you most?

The following letters are typical of the hundreds that come from our readers every month, telling us of the pleasure and profit they derive from reading POPULAR SCIENCE MONTHLY.

Won't you write, too, and tell us just what you think about this magazine?

What an Inventor Says

I am a man who has been inventing since I was 19 years old, and today I am 46 years old. I have read a good many magazines concerning inventions, but POPULAR SCIENCE MONTHLY is about the best I have read.—P. K., Mamaroneck, N. Y.

No More Haphazard Buying

Kindly send me the list of tools which the Popular Science Institute of Standards has tested and approved. I, for one, can appreciate such service as I often have bought tools only to discard them as worthless.—J. W., Evergreen, L.I., N. Y.

Wouldn't Miss an Issue

I have been taking POPULAR SCIENCE MONTHLY a long time and wouldn't miss an issue.—B. A. H., Montreal, Can.

Interested in Astronomy

I subscribe to your magazine because of your astronomical articles.—W. D. U., Niagara Falls, N. Y.

PATENTS TRADE-MARKS AND COPYRIGHTS

Have You An Idea? Our Offer: FOR THE PROTECTION OF YOUR INVENTION YOUR FIRST STEP



Before disclosing an invention the inventor should write for our blank form

"RECORD OF INVENTION"

This should be signed and witnessed and returned to us together with model or sketch and description of the invention for

INSPECTION and INSTRUCTIONS

No Charge for the Above Information

Our Four Books Mailed Free to Inventors

Our Illustrated Guide Book

HOW TO OBTAIN A PATENT

Contains full instructions regarding U. S. Patents. Our Methods, Terms, and 100 Mechanical Movements illustrated and described.

OUR TRADE MARK BOOK

Shows value and necessity of Trade Mark Protection. Information regarding Trade Marks and unfair competition in trade.

OUR FOREIGN BOOK

We have Direct Agencies in Foreign Countries, and secure Foreign Patents in shortest time and at lowest cost.

PROGRESS OF INVENTION

Description of World's Most Pressing Problems by Leading Scientists and Inventors

IMPORTANT

TO MAKE YOUR CASE SPECIAL AND AVOID DELAY YOU SHOULD HAVE YOUR CASE MADE SPECIAL IN OUR OFFICE to secure protection, save correspondence and obtain early filing date in Patent Office. To secure special preparation of your case send \$25.00 on account with model, or sketch and description.

All Communications and Data Strictly Confidential. Interference and Infringement Suits Prosecuted. Our Organization offers PERSONAL SERVICE by Experienced Patent Solicitors and Draftsmen.

We Regard a Satisfied Client as our best advertisement, and furnish anyone, upon request, lists of clients in any state for whom we have secured patents.

Highest References—Prompt Attention—Reasonable Terms

WRITE TODAY

**Free
Coupon**

VICTOR J. EVANS & CO.

Patent Attorneys

New York Offices 1007 Woolworth Bldg. Philadelphia Offices 714-715 Liberty Bldg. Pittsburgh Offices 514 Empire Bldg.
Chicago Offices 1114 Tacoma Bldg. San Francisco Offices Hobart Bldg.

Main Offices: 760 Ninth Street, Washington, D. C.

Gentlemen: Please send me FREE OF CHARGE your books as described above.

Name.....Address.....

Only 8 Weeks For A Big Pay Job

In the auto, tractor
and electrical business

Get my
AMAZING
OFFER

George W. Smith, of
West Alexandria, O.,
did it—in 8 weeks.
Read this: "Dear Mac:
I am clearing more than
\$800 a month. I'll tell
the world McSweeney
training put me over."
Signed—
George W. Smith,

My
FREE
BOOK TELLS HOW
write me now!

J. H. McSweeney, World's large operator
of Auto, Tractor and Electrical Training
Shops—Cincinnati, Chicago, Cleveland.

I'LL PAY YOUR RAIL-
ROAD FARE TO CIN-
CINNATI, CLEVELAND
OR CHICAGO, and YOUR
BOARD FOR 8 WEEKS

**BIG FIRMS NEED
TRAINED MEN**

I get calls daily from successful
concerns for McSweeney trained
men. They know McSweeney men
are shop-trained, experts on autos,
tractors and motors. That's why
McSweeney men are in demand.

My
Training
Unusual

Here's the big
secret—scientific
tool-training. I
train you with
tools, not text
books, on modern equipment and
in wonderful shops.

HOME TRAINING ALSO—in-
cluded in my special offer.

Write at once for my remarkable
short time tuition offer.

McSWEENEY
Auto, Tractor and Electrical
TRAINING SHOPS

9th & Walnut
Cincinnati, O.
516 So. Laflin
Chicago, Ill.
1815 E. 24th St.
Cleveland, O.

SEND FOR
FREE BOOK

McSweeney Auto, Tractor and Elec-
trical Shops, Dept. 132, (Address
nearest shops) Cincinnati, O., Cleve-
land, O., Chicago, Ill.
Without obligation send me your Big
FREE Book on Autos, and Full De-
tails of your Special Short Time Offer.
Name.....
Address.....
City.....

3 BIG SHOPS
CINCINNATI
CLEVELAND-CHICAGO

What a Cleaner Has Learned about Your Clothes

(Continued from page 24)

electric machinery, you have much to do
with fluids for storage batteries, fluxing
materials for soldering, and various
metal polishes. And if you are a plumber,
guard your clothes against mineral
acids and soldering solvents.

OUR spotters, in tackling stains, are
more cautious in their procedure
than the average man or woman who
tries to remove spots at home. When we
cannot identify a spot, we follow a
standard procedure for unknown stains.
This is to avoid "setting" the spot beyond
remedy. We use in the order given:
Dry solvents, wet solvents, semi-dry sol-
vents, reducing agents, and oxidizing
agents.

Even then, special problems frequently
occur.

For example, we were swamped one
day recently with 3000 men's shirts,
sent by a shirt concern. Every one of
these had been accidentally stained with
dark varnish during building altera-
tions. They were of various fabrics and
colors. To insure a process that could
safely be used, we sent samples of the
shirts to our expert chemist, who made
exhaustive tests.

These tests showed that a method
that proved successful with the silk
shirts changed the color of the cotton
shirts. In the end, we had to adopt three
entirely different processes—for the white
shirts, for the colored silk and for the
colored cotton shirts.

New facts are constantly being learned
in the science of removing stains, as in
every other line of work, and new for-
mulas for spotting solvents evolved. Gly-
cerine, for example, formerly was used
far more extensively than it is now, and
ammonia was for many years looked upon
by the earlier dry-cleaners as a cure-all.

JUST as a physician hesitates to order
his patients to take care of their own
small ills, so I would hesitate to suggest
that people try to remove spots and stains
from their clothing themselves. Yet there
are a few methods for removing
common stains that I think every one
should know. They are:

Fatty grease stains: On wash goods use
warm water and soap; but on delicate
fabrics use carbon tetrachloride, which
may be bought in any drug store under
various trade names. On fabric likely to
be injured by water, use absorbents, such
as blotting paper, fuller's earth, French
chalk.

Paint: Try to remove paint stains only
when they are fresh. If the material is
washable, plain soap and water will
remove them. Otherwise, sponge the
fabric with pure turpentine. If paint is
hardened, send to the dry-cleaner.

Axle grease, mineral oils, pitch: First
rub with vaseline, then apply carbon
tetrachloride.

Tobacco: Apply warm glycerine when
the fabric is colored; hot dilute alcohol
to white fabrics (but not to artificial silks).

(Continued on page 143)

**Play the
HAWAIIAN
GUITAR**
Just as the
Natives Do

Play in Half Hour
After you get the four
easy motions you play
harmonious chords with
very little practice. No
previous musical knowl-
edge necessary.

Free Guitar
and Outfit in Genuine Seal Grain
Fabricoid Case as soon as you en-
roll. Nothing to buy—everything
furnished. No delay.

FREE when
you enroll
**\$15 HAWAIIAN
GUITAR
and Case**

Only 4 Motions used in
playing this fascinating
instrument. Our native
Hawaiian instructors
teach you to master
them quickly. Pictures
show how. Everything ex-
plained clearly.

Easy Lessons
Even if you don't know
one note from another,
the 22 printed lessons
and the clear pictures
make it easy to learn
quickly. Pay as you play.

Write at Once
You'll never be homesick with
this beautiful Hawaiian Guitar.
Write for Special Offer and easy
terms. A postcard will do. ACT!

FIRST HAWAIIAN CONSERVATORY OF MUSIC, Inc.
9th Floor, Woolworth Bldg., Dept. 145 New York, N. Y.
Approved as a Correspondence School Under the Laws
of the State of New York

WANTED-MEN TO LEARN RADIO



Experts Earn \$75 to \$200 a Week
Right now, everywhere, big, easy
money is being made in Radio.
Field unlimited. You can master
Radio quickly at home in spare
time. No previous experience nec-
essary. Now is the time to enter
this new, uncrowded field.

1,000 Mile Receiving Set Given
With the Course—Our new home-study methods make
everything about radio amazingly
simple. No other course like it. Makes you expert on
radio operation, repairs and installations of all kinds.
Send for literature telling all about opportunities and how
we give 1,000 mile receiving set with the course. Don't
miss this big offer—ACT. Write now for big free book.

Radio Association of America
4511 Ravenswood Ave. Dept. 41 Chicago

The Electrician's Wiring Manual

By F. E. Sengstock, E. E.

Contains all the information
needed for the proper installation
of lighting and power systems in
housing and other buildings.
It completely covers inside elec-
trical wiring and construction in
accordance with the National
Electric Code.

Pocket size—flexible binding
448 pp. Price \$2.50

POPULAR SCIENCE MONTHLY
250 Fourth Ave., New York City

INVENTIONS Commercialized

ON A CASH OR ROYALTY BASIS
PATENTED or UNPATENTED

In Business 25 Years—Complete Facilities—References.

Write **ADAM FISHER MFG. CO.**
183-D Enright Av. St. Louis, Mo.

PATENTS

Trade-marks, Copyrights, Patent Litigation.
Handbook with illustrations, 100 mechanical
movements. Sent free on request.

ALBERT E. DIETERICH
Formerly member Examining Corp. U. S. Patent Office
Patent Lawyer and solicitor
27 years' experience

681-A Ouray Bldg., Washington, D. C.

PATENTS

BOOKLET FREE HIGHEST REFERENCES
PROMPTNESS ASSURED BEST RESULTS

Send drawing or model for examination
and report as to patentability

WATSON E. COLEMAN, Patent Lawyer
644 G Street N. W., Washington, D. C.



The Making of an Unusual Salesman

Here are Some of the Records

Big
JOBS
Now Open

After spending fourteen years as conductor on a railroad, I came in on my passenger run and never went out again. I saw there were wonderful chances in the selling field; so I started in selling real estate. The first month I did not make a sale. I saw I needed something to help me, so I took up LaSalle training Salesmanship. The next month I made \$700 and last month I averaged better than \$67 a day throughout the month.

C. A. THOMAS, California.

My salary was practically doubled a short time ago, but my greatest satisfaction comes from knowing that the amount of business I have written this year is easily five times greater than before.

S. N. WILLIAMS, Kentucky.

With or without previous experience, you may become an unusually successful salesman. Men who sent for this book from one to six months ago have doubled their earnings.

If you are seeking advancement or greater opportunity, get full particulars of the LaSalle salary-doubling plan. The coupon will bring it to you, together with two valuable books—"The Making of an Unusual Salesman" and "Ten Years' Promotion in One," all without obligation.

If a successful career is worth two cents and two minutes of your time, clip and mail the coupon NOW.

LASALLE EXTENSION UNIVERSITY

The World's Largest Business Training Institution

Dept. 183-SR Chicago

Please tell me about your salary-doubling plan as applied to my advancement in the business field checked below. Send also copy of "Ten Years' Promotion in One," all without obligation.

Modern Salesmanship

- ☐ Business Management
- ☐ Higher Accountancy
- ☐ Traffic Management
- ☐ Railway Station Management
- ☐ Law, Degree of LL. B.
- ☐ Commercial Law
- ☐ Industrial Management Efficiency
- ☐ Banking and Finance

- ☐ Modern Business Correspondence and Practice
- ☐ Modern Foremanship and Production Methods
- ☐ Personnel and Employment Management
- ☐ Expert Bookkeeping
- ☐ Business English
- ☐ Commercial Spanish
- ☐ Effective Speaking
- ☐ C. P. A. Coaching

Name.....

Present Position.....

Address.....

LEARN TO DRAW!

Remarkable book—"COMMERCIAL ART AND CARTOONING." Explains how to make illustrations for books, advertisements, etc. Also how to become a Cartoonist. NO CORRESPONDENCE COURSE—Book tells all—14 chapters—125 illustrations. Explains Elementary Drawing: Still Life, Pen, Ink, Charcoal and Crayon Work; Cartooning, etc. Bound Flexible, Im. Leather. Postpaid for \$2.00 (C.O.D. 17c extra). OGLVIE PUBL. CO., 57 Rose Street, New York, Dept. 134

Wrestling Book FREE

Learn to be an expert wrestler. Know scientific wrestling, self-defense, and jiu-jitsu. Develop a splendid physique, and have perfect health. Join this popular school and learn by mail. The famous world's champions—the marvelous Frank Gotch and Farmer Burns offer you a wonderful opportunity. Wrestling is easily and quickly learned at home by mail. Men and boys write now for splendid free book. Learn all the science and tricks. Be able to handle big men with ease. Accept this wonderful offer NOW. Send for free book today, stating your age.

Farmer Burns School of Wrestling, 1781 Range Bldg., Omaha, Neb.

What Could You Do with \$50—?

See the Cash Prize Offer on Page 4.

What a Cleaner Has Learned about Your Clothes

(Continued from page 142)

Coffee: Use soap and water (not hot); then, if necessary, potassium permanganate.

Mud: Let dry and brush thoroughly. Sponge with alcohol (but not if artificial silk).

Water spots: Dampen the entire garment, and press while still damp.

Since people took to soft drinks, and to staying home evenings for radio concerts, and to going away for week-end auto trips, we've had to cope with stains that were unknown to our predecessors 50 years ago.

A WHITE georgette wedding dress was brought to us by a young bride one day last winter. She had worn it two or three times, and wanted it cleaned, so that she could pack it safely away.

The dress appeared slightly soiled, but otherwise spotless. However, when it came through the dry cleaning, we found a yellowish stain on one of the panels. Nothing would remove it. We finally sent the panel to our chemist for a report. Ginger ale or some other soft drink, spilled on the dress, and perhaps unnoticed at the time, was found to have been the original cause of the trouble. If the young woman had told us of this in the first place, we easily could have removed the ginger ale by water brushing. As it was, an entirely new panel had to be sewn into the dress.

People did not chew gum a century ago, nor drink malted milk, condensed milk, or even pasteurized milk. They didn't know the taste of ice cream. Indelible ink, road oil, perfumes, battery acid, lipstick and rouge—these, too, are leaving the fingerprints of twentieth century civilization on our clothing. The dry cleaner receives this by-product in the form of new stains, to the removal of which he must apply all the ingenuity and chemical knowledge at his command.

ADVANCES in the industry have given the dry cleaners an equipment consisting of machines to cleanse the garments in the solvent (washers); machines to remove this solvent from the cleansed garments by centrifugal action (extractors); and machines to dry and deodorize the garments (tumblers).

A recent revolutionary step in the industry was the introduction of the so-called "continuous flow" system. This made an automatic "clarifier" an integral part of the cleansing process. The solvent now flows in a continuous passage from the washer to the clarifier and back to the washer—returning as a cleansed solvent. This has eliminated the laborious and repeated rinsings in fresh loads of solvent.

An even more recent innovation is the introduction of a semi-nonflammable solvent, a heavy petroleum with an initial boiling point of from 280 to 300 degrees F. and an end point of from 400 to 420 degrees. If generally used, it is hoped that this solvent will considerably decrease the number of explosions and fires in dry-cleaning plants, and protect the lives of the operators.

This Tenor Banjo

FREE

WHEN YOU ENROLL—Worth \$18.00

Thousands Enjoy Popularity!!

Popularity can be yours. We start you by presenting this handsome, full size, professional tenor banjo. We want to make one thousand new friends this month. We want to present one of these wonderful, delightful instruments as a gift to each of one thousand readers of this magazine—and here's why. Before becoming a professor and a lover of music, particularly the tenor banjo, our professor yearned and yearned for the possession of a genuine professional instrument, the same kind used by the big, successful professionals of the world. Now we want you to succeed. We want to help every music-lover that we can, attain success, and this gift offer is made to pave the way for you, and no previous musical knowledge is necessary.

We have another surprise for you! Not only do we start you on the way to popularity, success and fame by supplying you with an instrument that you can compare to any used or displayed in your town, but under personal supervision you will be given, by mail, the benefit of Professor Harry Six's twenty-two years' experience as director of Glee and Instrumental clubs of New York University. We don't just send you a lot of printed words and instructions and trust to luck that you will catch on. Our method is different and has proven to be the simplest devised by man—that is why we claim you'll be able to play in thirty minutes. Put us to the test.

Learn in 30 Minutes With My Picture Method

Arthur Brisbane, the highest paid journalist in the world, once said that "a single picture is worth a thousand words." He was right, for it stands to reason, when you take your instrument in hand along with the actual photographs of the professor in action as your guide, it is easy to imitate and do the right thing. But that is not all.

We also furnish as an additional guide, phonographic records of the professor playing the pieces you are learning, along with our thorough, printed and illustrated, easy-to-read course. Doesn't that sound easy? It is easy. If you could sit at my desk and see the letters and telegrams from our pupils, you would be convinced that we have perfected the simplest, yet most highly efficient course to insure your mastering the tenor banjo.

Don't Send a Single Cent

Investigate offer today. Don't put off until tomorrow, because you might forget and miss this wonderful opportunity. It might be the turning point in your career. Don't send a single cent. Just drop a line—use coupon, or postal card will do—telling you are interested in receiving full particulars about course and to reserve one regular eighteen dollar, full size professional tenor banjo for you, which is offered as a gift.

Act quickly, because there may not be enough gift banjos to go around for the million readers of POPULAR SCIENCE. This does not obligate you in any way. Therefore do not hesitate—put in your reservation now, this very minute. You will soon join our happy army of enthusiastic, finished tenor banjo musicians.

EARN BIG MONEY—

Hundreds have started orchestras and are making money.

FREE BANJO COUPON

New York Academy of Music
Studio 51, 100 Fifth Ave., New York

Please rush all free information relative to your Tenor Banjo Course, sample lesson and reserve a gift tenor banjo for me. This obligates me in no way whatever.

Name.....

Address.....

City.....State.....



HIGH SCHOOL COURSE IN TWO YEARS

YOU ARE BADLY if you lack **HANDICAPPED** High School training.

You cannot attain business or social prominence. You are barred from a successful business career, from the leading professions, from well-paid civil service jobs, from teaching and college entrance. In fact, employers of practically all worth-while positions demand High School training. You can't hope to succeed in the face of this handicap. But you can remove it. Let the American School help you.

FIT YOURSELF FOR A BIG FUTURE This course,

which has been prepared by some of America's leading professors, will broaden your mind, and make you keen, alert and capable. It is complete, simplified and up-to-date. It covers all subjects given in a resident school and meets all requirements of a High School training. From the first lesson to the last you are carefully examined and coached.

USE SPARE TIME ONLY

Most people *idle* away fifty hours a week. Probably you do. Use only one-fifth of your wasted hours for study and you can remove your present handicap within *two years*. You will enjoy the lessons and the knowledge you will gain will well repay the time spent in study.

Check and mail the coupon NOW for full particulars and Free Bulletin.

American School

Dept. H-175

Drexel Ave. and 58th St., Chicago

American School

Dept. H-175 Drexel Ave. & 58th St., Chicago

Send me full information on the subject checked and how you will help me win success.

- | | |
|------------------------------|----------------------------|
|Architect |Business Law |
|Building Contractor |Lawyer |
|Automobile Engineer |Machine Shop Practice |
|Automobile Repairman |Mechanical Engineer |
|Civil Engineer |Shop Superintendent |
|Structural Engineer |Employment Manager |
|Business Manager |Steam Engineer |
|Cert. Public Accountant |Foremanship |
|Accountant and Auditor |Sanitary Engineer |
|Bookkeeper |Surveyor (& Mapping) |
|Draftsman and Designer |Telephone Engineer |
|Electrical Engineer |Telegraph Engineer |
|Electric Light & Power |High School Graduate |
|General Education |Wireless Radio |
|Vocational Guidance |Undecided |

Name.....

Address.....

What 10,000,000 People Like to Hear on the Radio

(Continued from page 64)

"Of course, there are freak letters coming in all the time," he continued with a smile. "If our chief announcer were not already married, he could have had a wide choice in wives from among the number of feminine listeners who have fallen in love with his voice and actually proposed marriage by mail, sight unseen! Then there are the listeners who send in presents as a mark of their appreciation. Everything from a peck of extra large potatoes to a pair of fireman's heavy, red suspenders elaborately embroidered!"

Although talks and lectures do not seem to be rated very high on the scale of what the modern listener likes, this certainly does not apply to such features as morning health exercises.

THE director of the largest morning gym class in the world, who gets enormous numbers of men and women out of bed at 6.45 every morning just to exercise according to his instructions over the radio, told me that in the last year he had received upward of 100,000 letters from radio listeners who stated that they were consistently following his course.

It is estimated that not 10 per cent of radio listeners ever write to a broadcast station, so it is easy to make a pretty good guess as to the actual number of people who follow his course.

And that they are greatly benefited is shown by letters such as this:

You stated over the air this morning that you would like to hear from your radio audience regarding loss of weight through doing the exercises you broadcast every morning. I am very much pleased to be able to report progress in that direction.

On March thirtieth last, I weighed 205 pounds and was getting one of those things that keeps a fellow from seeing his shoes. June fifth I weighed 193, July first, 191, August first, 189, and September fifteenth, 180. In other words, I lost 25 pounds in 5½ months. Don't you think this gradual reduction is all right? I am now just about what I should weigh for my height and age.

The public wants entertainment by radio. They have received medical treatment by radio, and now they lose weight by radio.

Recent Publications

The Marvels of Modern Physics, by Joseph McCabe. Atoms, electrons, wireless electricity, and other wonders of physics explained. Illustrated. G. P. Putnam's Sons.

Our Insect Friends and Foes, by William Atherton Dupuy. Interesting stories of everyday insects. Illustrated. The John C. Winston Co.

The Engines of the Human Body, by Sir Arthur Keith. The human body explained from the viewpoint of a mechanical engineer. Illustrated. J. B. Lippincott Co.

Automotive Repair, by Homer J. Smith and Roy S. Kern. Working manual for students, automobile owners, and repair men. The Manual Arts Press.

A resident school—not a correspondence course

NOW—A Shop Course in ELECTRICITY At Correspondence School Price

HERE is the greatest electrical news in years. Greer College for a limited time is offering the complete electrical course at a price that will give young fellows the chance they need—the chance to get the right start in this great, fast growing, money-making profession—practical electricity. A resident school at the price of a correspondence course. Think what that means to you! You can now fit yourself for a big job with a big future and the training will take you only 12 short weeks.

Wonderful Future in ELECTRICITY



You are standing right on the threshold of a great electrical age. Here is the chance of your lifetime to get in on the ground floor. Men who know are in great demand, and the need is growing faster all the time. Get into the game now while the field is uncrowded—while advancement is fast and sure. Learn to supervise other men's work, or to go into business for yourself. Now is the time.

The Practical Way to Start in the Electrical Business

The Greer electrical course offers the practical, sensible way to break into this wonderful field. Instruction is in charge of former leading instructor of the U. S. Veterans' Bureau Electrical School on Karlov Ave., Chicago. You learn by the job-sheet system, which was found so effective when the veterans' school was in operation. No time is spent in useless theories. Actual electrical problems are assigned from the first day. The course is made so interesting and practical that you will enjoy every minute.

Equipment—Finest Money Can Buy

No expense has been spared to make our equipment absolutely complete and up-to-date. We have over thirty kinds of motors—not toys—but real, working motors. We operate a high line in our shops, carrying 2300 volts, a step up of 10 to 1. We have an alternating current generator, something unusual in training shops.

Our equipment and our methods make this the ideal place to learn the practical, money-making end of electricity.

Now Is the Time

This winter is the ideal time to get your training. In 12 weeks you will be ready to start on a worthwhile job with a future. You will be just in time for the spring rush, when there will be more need for practical electricians than ever before. If you want to, you can start a small shop of your own. There are thousands of wonderful opportunities for men who really know the business.

Free Employment Service

Our employment department will help you get started in the right job as soon as you finish training. If you need to earn money while learning, we will arrange a part-time job to suit your convenience. Night classes for men who cannot attend in day-time.

Don't Delay a Minute

Send in this coupon and by return mail you will get our big free book and the remarkable offer made for a limited time. Clip the coupon now and send it in.

Greer College—Automotive and Electrical Engineering

Erwin Greer, President,
Greer College—Automotive Electrical Engineering,
Dept. 102, 2024 S. Wabash Ave., Chicago.

Please send me your FREE BOOK and offer for electrical course. It is understood that I am not obligated in any way.

Name.....

Address.....



How to Paint Your Car

(Continued from page 66)

for—one priming coat, then two coats of paint and a finishing coat of varnish. The first three coats have to be rubbed down with pumice stone or fine sandpaper and the car gone over with a tack rag. If I tried to do a real high class 'coach job' with many thin coats, we'd be snowed under with the spring repair work before I could get it finished. Besides, I'd get tired of leaving the car here while I walked home every day."

THE bookkeeping end of the business at the Model Garage, which Joe took care of, being light just then, Joe had considerable time to spare. He pitched in to help Gus with the sandpapering and dusting.

"Just see how easy it is to get the paint nice and smooth with this brush," Gus pointed out, when they had smoothed down the priming coat, and he began to apply the second coat.

"That's because you are using good paint," said Joe.

"Sure it's good paint! Didn't I mix it myself? But if you'll take a good look at this paint brush you'll see why the paint flows so smoothly. That's no 39-cent bargain sale brush made out of pig's whiskers stuck in the handle with glue. No, sir! It's pure badger hair set in rubber, and I'd hate to tell you how much money I parted with to acquire it," Gus stated with the enthusiastic pride of a good workman in a fine tool.

"So the brush makes a lot of difference, does it?" Joe asked with interest. "Why, I thought that anything with bristles in it would do. I'd have used a cheap brush that I could afford to throw away after I'd finished and save myself the trouble of cleaning it."

"THERE'S where you're all wrong," said Gus with emphasis. "Cheap brushes may be all right to use on a cowshed, but you can't do a really fine job with 'em. They simply will not flow the paint on smoothly, and you spend half your time picking off the bristles that keep coming out of the brush."

By the end of the week, the first three coats had been put on. Gus made sure that each coat was thoroughly dry before he applied the next one. Of course, each coat was sandpapered lightly and Gus and Joe spent a lot of time on the dusting.

"Now comes the hardest job of all," Gus announced the morning after they had finished sanding and dusting off the third coat of paint. "Today I'm going to flow on the finish varnish coat, and I'm going to have it absolutely smooth and glasslike all over or bust a leg trying!"

"Get the oil stoves going, Joe, while I wet down the floor and walls so that walking around won't raise any dust. Then when the temperature is up to 70 degrees you can go outside and see that nobody races a motor in the garage or does anything else that would be likely to kick up a lot of dust or jar any down from the ceiling."

(Continued on page 146)



Why Dance in the Old Fashioned Way —When It's So Easy to Be Up-to-Date?

Want to be truly popular? Want to be invited everywhere? Want to enjoy parties and get real joy out of dancing? Here's how! Learn to dance the new peppy way and see how you begin to be in demand as a partner!

No one enjoys dancing with a "walk around" who thinks he's getting by because he knows a few old-fashioned steps. You simply can't dance that way to the new ballroom music. You must know the latest steps, the joyous modern steps that everyone is doing!

Those lumbering dances they used to do before jazz laughed its way into the ballroom—those awkward, old-fashioned steps—get rid of them. Learn to dance the new way and see what a difference it makes. Not only will you be more popular, not only will you be a favorite partner, not only will the girls like to dance with you, but—*You yourself will get more joy out of dancing!*

No longer will dancing be a ballroom duty, but a pleasure. At the end of a dance you won't feel tired, but exhilarated. You can dance all night the new way, and enjoy each dance more than the one before. It's great.

Arthur Murray's Famous At-Home Method

Of course you want to dance the new way! Why don't you let Arthur Murray teach you—his fascinating, quick, at-home way—without partner, without music, in the privacy of your home? You'll get real pleasure out of it. Quicker than you'd imagine possible, you'll learn how to do all the modern jazz steps that make a dancer popular.

To prove it Mr. Murray is willing to send his new illustrated book, "The Short Cut to Popularity," to anyone who requests it.



YOU CAN BUILD THIS IDEAL WORK-BENCH—YOURSELF

THE pleasure of working with tools at home is greatly increased if you have a strong substantial bench with a good vise. One that also has drawers and tool cabinets is a constant incentive to keep tools in order and give them the care and attention they deserve.

A blueprint of the Home Workbench illustrated, with full size details and bill of materials may be obtained by sending 25 cents to —

POPULAR SCIENCE MONTHLY
250 FOURTH AVENUE NEW YORK

Send for this FREE book —TODAY!

This free book describes Mr. Murray's unique method of teaching in detail, and also includes a special test lesson from his famous course FREE. Just send the coupon (with 10c to cover cost of printing and mailing) and this interesting book with the free lesson will be forwarded at once.

No, don't wait—you may forget—clip and mail this coupon NOW.

ARTHUR MURRAY
Studio 580, 7 East 43rd Street,
New York City.

Arthur Murray, Studio 580
7 E. 43rd St., N. Y. C.

Please send me your 32-page book and Special Test Lesson. I enclose 10c to cover postage, printing and mailing

Name.....

Address.....

City.....State.....

How to Invent

Edison Says Invention is a Science and should be taught as a profession

One Idea May Win You a Fortune

Thousands of inventions are needed today. Just one little idea can bring you fortune and fame. The world is waiting for new inventions in engineering, chemistry, household articles, radio, and other fields—and will pay big money for even the simplest idea.



Little things like the tin bottle cap, the crimped hair-pin, the rubber on the end of a pencil brought their inventors hundreds of thousands of dollars. Couldn't you make some equally simple invention. Haven't you ideas that could be turned into money. Inventing isn't a matter of blind luck—it isn't a question of guess-work. Invention is based on certain principles, just as any other profession.

It follows a definite course of procedure step by step from the origination of the first idea to its final development on a commercial scale.

Learn at Home in Spare Time

Hitherto, every inventor had to work out these principles of invention for himself. For every successful inventor knows and uses these principles. He knows WHAT TO INVENT and HOW TO INVENT. But now you can learn in a few months what it took great inventors years of discouragement and terrific struggle to acquire. Fifteen famous inventors have now revealed, for the first time, the secrets of invention. They explain how to originate ideas, how to develop and perfect your ideas, how to patent your inventions, and how to sell them to your best advantage. In short, they make it amazingly easy for you to become an inventor, simply by learning the whole wonderful science of invention, step by step, from beginning to end. It requires just fascinating moments of your spare time at home.

First Course of Its Kind

This is the first course in practical invention that has ever been devised. Now you can take Edison's advice and actually learn HOW TO INVENT—how to make invention a profession! In simple, easy-to-understand language, you are told how successful inventors work; you learn how to use the secrets of invention that convert a simple little idea into money.

FREE New Book on Inventive Science

A wonderful new book has just come from the press that tells all about the Science of Invention; that shows how great inventors work, how little ideas have made fortunes; how you, too, can easily learn the secrets of successful invention. This fascinating book will be sent free to all those who are genuinely interested. Send for this book today, as only a limited number are available for free distribution. Write your name and address on the coupon below, or send a post card NOW! There is no cost or obligation.

BUREAU OF INVENTIVE SCIENCE
Dept. 21, Wisner Building, Rochester, N. Y.

Bureau of Inventive Science, Dept. 21
Wisner Building, Rochester, N. Y.
Please send me your free book, "The Science of Invention."

Name.....

Address.....

City.....State.....

How to Paint Your Car

(Continued from page 145)

"Why be so fussy?" said Joe. "What little dust you might get on the car by walking around won't hurt the varnish any."

"Don't you believe it," Gus stated decidedly. "That's why most amateur jobs look so punk. The least bit of dust on the varnish, and the bird who did the job has to tell all his friends that it looks fine if you stand 20 feet away!"

"Just to be sure, I'm going to strain this varnish through a piece of that cotton cloth. Then, if there are any lumps or particles of grit in it, they won't have a chance to show up like warts on the finished surface."

Joe followed Gus's instructions so literally that he made two customers shut off their motors at the door and pushed the cars inside by hand.

The next morning Gus, with a great deal of pride, invited Joe in to see the result of his handiwork.

"THERE!" he said. "That's pretty darn near as good a job as any professional auto painter could turn out."

"Sure looks swell," admitted Joe admiringly, as his eyes traveled over the smooth shining surface—no trace of dust or a brush mark anywhere.

"We ought to go into the auto painting business if you can do as good a job as that," he suggested. "By the way, I was looking over my flivver last night, and as far as I can see, the paint is perfectly good, only it's kind of dull. Could I freshen it up if I put a coat of finishing varnish on it?"

"If the paint isn't cracked or checked you can do a good job that way," replied Gus. "These quick drying auto enamels are pretty good for such a job, but you must be just as careful about dust as if you were trying to apply coach varnish. That's what most of the enamels are, anyway—high grade varnish with color added. Only be sure that you buy the best grade you can get; some of the cheap grades show white when the car gets rained on and they begin to look shabby before a month has gone by."

"Don't forget the heat, either. There was a fellow I know who put on a coat of one of these one-day-drying auto enamels in a cold garage in the middle of winter. It took nearly a week to dry and meanwhile dust blew in through the cracks in the door. That job looked like it had been done in a concrete factory."

"And as for going into the painting business—nothing doing! I'd rather pull down three transmissions and four rear ends than do one paint job. I'm an auto mechanic—not a painter."

"This bus is finished now," he declared, as he started in to clean up his brushes. "We'll let it sit there for a couple of days and then I'm going to shower it down with cold water to set the surface of the varnish. Then I'll wipe it off with a piece of chamois skin and after that I'll roll down Main Street thinking I'm fooling everybody into believing that I have a new car!"

FOURTEEN MEN WANTED

Hand-Picked

Fourteen men who like ELECTRICAL WORK will be given an unusual opportunity. Must be over 18 years of age. Must now be employed in some legitimate work. Must have had 7th grade schooling and be able to give at least two character references.

Success to be Forced on Them

The Electrical field has hardly been scratched and, in view of the rapid changes now taking place and the new discoveries being made, a man must be thoroughly trained in fundamental Electrical principles if he expects to be anything more than a common laborer in the Electrical field.

Can You Qualify?

The fourteen men selected will be trained at home in actual work by the new practical job-method while still retaining their present positions. Their training will be planned to enable them to qualify for a good position and increased pay in the shortest possible time.

If you wish to share in this opportunity—if your wishbone has not switched places with your backbone, and if you DO realize the absolute necessity and value of a practical education, then write me immediately for full information.

MAIL THIS COUPON

Chief Engineer Dunlap, Apt. E174A, 850 E. 58th St., Chicago

Please send me complete information about the offer to prepare me for an Electrical Expert's position.

Name.....

Address.....

Your Choice

\$20.00

Musical Instruments

FREE To Our Students

Your choice of a Violin, Tenor Banjo, Hawaiian Guitar, Banjo, Cornet, Ukulele, Banjo Ukulele, Guitar, Mandolin or Banjo Mandolin. You will be proud to own any one of these instruments and you can have one absolutely free. A few cents a day for lessons is your only expense. Our system of teaching is so easy that you can play several pieces by note with the first four lessons. We guarantee success or no charge. Instrument and lessons sent on one week's free trial. Write for booklet today, no obligation.

CHICAGO CORRESPONDENCE SCHOOL OF MUSIC
Orchard and Willow Streets, Dept. 29, Chicago, Illinois

SIGNS and SHOW-CARDS PAINTING MADE EASY

You, too, can paint attractive signs and showcards with the aid of Letter Patterns. Simply trace around the letter pattern and fill in. You will be astonished how quickly you can paint a sign by this method. These patterns are cut from durable oiled stencil board with smooth edges, which allow for rapid outlining. Each alphabet contains all the letters and the character &. Send stamp for free samples or better still order a few sets.

ABC NO. 1	ABC NO. 4	ABC NO. 8	ABC NO. 13	ABC NO. 18
ABC NO. 2	abc NO. 7	123 NO. 9	abc NO. 14	abc NO. 19
123 NO. 3	123 NO. 6	ABC NO. 5	123 NO. 12	123 NO. 20

Price Each Alphabet, 1 1/2 in. 50c, 2 in. 60c, 3 in. 75c, 4 in. 95c, 6 in. \$1.50. Nos. 7, 14, and 19 Lower Case made only as follows: 1 in. 50c, 1 1/2 in. 60c, 2 in. 60c, 3 in. 75c.

Price of Set of 10 Numerals, 1 1/2 in. 25c, 2 in. 30c, 3 in. 35c, 4 in. 45c, 6 in. 70c. Order by Number and give size. All orders from this advertisement receive prompt attention and will be sent by parcel post.

JOHN F. RAHN 2120 No. Neva Ave., Chicago, Ill.

Learn Photography at HOME

Earn \$3000 to \$10,000 a year. Prepare quickly during spare time. Also earn while you learn. New easy method. Nothing else like it. Send at once for free book, "Opportunities in Modern Photography" and full particulars. Special offer open now.

INTERNATIONAL STUDIOS, Inc.
Dept. 1361, 3601 Michigan Ave., Chicago, U. S. A.

Is Your Memory Really Bad?

(Continued from page 27)

who have remarkable memories for sport statistics. They can tell you football scores and baseball batting averages without end. They don't learn these facts to show off, but simply pick them up because they are interested keenly in athletics.

When I went to Amherst, the president of the college was famed for his memory. It was said that once he had met a student, he never forgot that student's name, no matter how many years intervened. The secret was profound attention. He made it a point to have a 15- or 20-minute interview with every freshman. I remember all the while I was in the office he was studying me closely. First he made sure to get my name correctly. During the interview he used my name five or six times. As a result, at the end of the 15 minutes he had my name and had it linked to my personality.

DO YOU find it hard to remember names? If you do, this repetition trick will help greatly. When some one introduces you to Mr. White, say, "Oh, yes, Mr. White. I'm glad to meet you, Mr. White. A relative of the Whites of Chicago? No? Mr. White, there, is a good friend of my father."

Punning on names helps, too; remembering names by their resemblance to the names of animals, familiar objects, and so on; but don't try this with strangers right off the bat. If you can slip the name into a classification, that will help, too. Some names sound aristocratic. Other names indicate immediately a certain nationality. Recalling that it was a name of Irish origin would help in bringing back the name of O'Brien. The name may be that of a color, such as Green or Gray, or you may think of other possible groupings.

Mechanical aids help in improving your memory in special lines. Make up little stories that link the facts together.

Thus, in a comparative word-memory test, such as is shown on page 26, you are given a list of words in pairs, then later given one of each pair and asked to recall the other. The easiest way to remember these is to establish a story connection. Suppose the words are "dark" and "toe." "The man stubbed his toe in the dark." This little story serves to link the two words so that later you can recall them together.

YOU probably have not a few facts in your mental storehouse that you recall by means of doggerel. You may, for example, remember the date of the discovery of America by using the old rhyme, "In fourteen hundred and ninety-two, Columbus sailed the ocean blue." And no doubt you remember the months that have 30 days by the familiar, "Thirty days hath September" jingle.

Such mechanical aids are useful—provided, of course, that they are not so complicated as to make remembering the method more difficult than remembering the facts themselves would be. While on the subject, I recall a shorthand version of the "Thirty days hath September"

(Continued on page 148)

FREE PROOF



I don't care how large your waistline may be. I don't care what diets, muscle-straining exercises or harmful drugs you may have tried, without any of these—only with this remarkable belt

I Can Make You Inches Thinner—In 30 Days—Or No Cost

Off with that bulging waistline! With my new self-massaging, all-rubber reducing belt, I guarantee to give you an instant appearance of slimness—and to permanently remove your excess stomach fat easily, pleasantly, and in an amazingly short time—or it costs you nothing.

Lose Weight—Gain Health

My Scientific Reducing Belt operates on exactly the same principle used by the expert masseur. It not only makes you look slim at once, but with every move you make, with every breath you take, it gently massages the loggy abdominal tissues and the fat vanishes. From 4 to 6 inches

usually disappear in 30 days or less. Thousands of men who were bur-

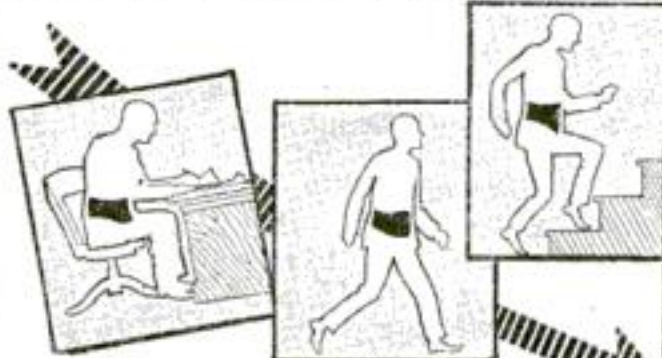
Every Move Helps Take it OFF

dened with excess fat have acquired a normal waistline in this new, easy, inexpensive way. It is endorsed

by physicians and athletes everywhere. Satisfaction is guaranteed, or your money back without question.

Don't Send a Cent

Mail the coupon today for full description. If you act promptly, I will give you the advantage of a special 10-day trial offer. So mail the coupon—right away. Address THE WEIL COMPANY, 101 Hill Street, New Haven, Conn.



As shown above, every move of your body, walking, climbing stairs, merely breathing as you sit—causes the Weil Belt to massage your abdomen. It is working for you every second.

THE WEIL COMPANY,
101 Hill Street, New Haven, Conn.

Gentlemen:—Please send me, without obligation, complete description of the Weil Scientific Reducing Belt and also your Special 10-Day Trial Offer.

Name _____
Address _____
City _____ State _____

Make More Money

Read the Money Making Opportunities on pages 120 to 150 of this issue.

A BETTER JOB NOW—FOR YOU

Earn \$2,000 to \$10,000 a Year!

Why work for small pay? Learn a good trade. Know autos—how to repair them. Get a better job—Now! Or a business of your own. Learn in a few weeks here at the great auto-trade school in the heart of the auto industry. Think of the repair work on eighteen million cars! There are not nearly enough trained men to do this work. **TRAINED Auto Men Are Wanted!** You can be a skilled mechanic and auto electrician and **Earn Big Money.** Experience not necessary. If you are mechanically inclined come to Detroit now, to the Old Reliable "Michigan State."

Learn Autos in Detroit THE HEART OF THE INDUSTRY

Here you have wonderful advantages. Study autos, trucks, engines, auto electricity, tractors. All on best equipment, up-to-date. Many new cars including Packard "Straight Eight" with four wheel brakes, Buick Six (four wheel brakes), Oakland (four wheel brakes), new Oldsmobile, Hupp, Reo, Hudson, many others. Hundreds of engines and electrical systems. Expert instructors to teach you; a thorough course that slights nothing. Visit the great plants of Ford, Cadillac, Packard, Lincoln, Dodge, Hupp, Hudson, Studebaker, many others. These great companies endorse this School. Get factory endorsed training at Detroit, the Auto Center. **Good Positions Open.** Here's your chance to be independent. The demand for trained auto men is greater than the supply. Opportunities everywhere. Write today for full information about Detroit training to make the most money.



Michigan State Automobile School
381 Auto Building, Detroit, Michigan

GET THE FACTS—TODAY!

MICHIGAN STATE AUTOMOBILE SCHOOL,
381 Auto Building, Detroit, Mich.
Send me FREE and without obligation complete information about Detroit-training to make the most money.

Name _____
Street or R. F. D. _____
City _____ State _____
I am interested in ☐ Resident Course at your School.
☐ Home Study Course.



Be a Dental Laboratory Expert!

Let McCarrie Train You!

H. A. McCarrie, Director, McCarrie Schools of Mechanical Dentistry, Chicago, Detroit and Cleveland.

few months in my big schools at Chicago, Detroit and Cleveland.

Many McCarrie Graduates Earn \$65 to \$125 a Week!

70,000 busy Dentists MUST send their laboratory jobs to Experts, specialists in the making of plates, crowns, bridges, etc. This business is growing. The work is easy, interesting. In my big FREE book I tell you all about the wonderful opportunities waiting for trained Dental Laboratory men.



"Earnings four times larger."

"I am still with Dr. Medina, doing all his work and making good. My earnings are four times larger than before I entered school. Thank you for assisting me to this fine position."

J. CARRILES.

Open a Laboratory of your own

Very little capital is needed to go into business when you have McCarrie training. My instruction includes training in Laboratory methods and management.

R. R. FARE to Chicago, Detroit or Cleveland

to every student who enrolls. Actually FREE, because I have not raised the price of tuition a penny since announcing this offer. For a limited time also, I am supplying every student with a complete outfit of new tools and materials. Tuition within reach of the untrained fellow who wants to get ahead. Easy terms.

Mail COUPON for FREE CATALOG and special offers.

H. A. McCarrie, Director McCarrie Schools of Mechanical Dentistry, 1338 So. Michigan Ave., Dept. 1402A, Chicago, Ill.

H. A. McCarrie, Director McCarrie Schools of Mechanical Dentistry 1338 S. Michigan Ave., Dept. 1402A, Chicago

I want to know more about the Dental Laboratory business, your schools and training. Also send me your special offers mentioned in POPULAR SCIENCE (without cost or obligation.)

Name

Street No.

City State

Don't crowd into the old overcrowded trades. Before you decide which line of work to go into—look into Dental Laboratory business. You'll find it's an interesting, easy, WELL-PAID Mechanical profession—easily learned in a few months in my big schools at Chicago, Detroit and Cleveland.

Rapid, Practical Training

I have successfully trained men and women with only common schooling and no previous experience. No text books, no classes in my schools. You learn here by doing actual Dental Laboratory jobs on standard tools which I supply without extra charge. Individual, personal instruction only.

I help you get a good job!

We maintain an efficient Employment Service for the benefit of students who wish to "work their way thru" and graduates. No charge for this service.



Lower removable bridge needed where molars are missing on one side only. Made by McCarrie student



Laboratory of Glen Davis one of my graduates.



"Course intensely practical."

"Any man who wants to become a first class mechanical dentist can do so at your schools. You teach by making the student do actual work."

E. SCHNEIDER (Penn.)

Is Your Memory Really Bad?

(Continued from page 147)

sequence. It is the single word "apjun-seno," made up, as you can see, by combining the first letters of the names of each of the 30-day months in the order of their occurrence.

I know some persons who remember telephone numbers by making words of them. Each digit has a corresponding consonant. Between the consonants they fit vowels and make a word that is linked to the person's name. For instance, Mr. Brown's telephone number is 5179. Suppose the consonants corresponding were g, b, l, and n. Think of the word goblin. A brown goblin—there you have it.

A GOOD way of compiling the code that corresponds to the 10 digits is by selecting letters that resemble in some particular the numbers for which they stand. Thus l might equal one; n (two upright lines like the Roman numeral) two; m (three lines) three; r (last letter of name of number) four; v (Roman numeral) five; p (resembles the number inverted) six; t (capital resembles the number) seven; sh (arbitrary choice) eight; g (written, resembles the number) nine; and z (first letter of name) zero.

Such a code has the additional advantage that the sounds are not repeated, and consequently any word formed from the letters will stand for one set of numbers and one only. By this system the number 1002 would become l-z-z-n, suggesting the word "lesson"; the number 8640, sh-p-r-z, suggesting "shippers."

One man who makes many public speeches locates each successive "point" of his speech in a corner of the hall or in a room of his own house. Then when he has finished one point he looks in the next room and this instantly recalls the next point of his speech.

Last year there was a young Lithuanian at Columbia University who astonished every one with a remarkable memory demonstration. He could state correctly from memory the logarithms for figures from one to 100, and could call off any of 300 numbers previously arranged in a list, when only their location in the list was indicated. It was understood that the young man had prepared for his exhibitions by memorizing the list. Even so, it was an impressive stunt.

HE EXPLAINED that he did it by associating the numbers with various colors of the spectrum and that his powers were exclusively visual. He merely translated colors that he saw back into numbers.

Supposing you have carefully organized the material that has gone into your brain. Your background of information, your ability to think of things in large units, your interest, attention, and repetition have helped to make vivid impressions. You have a healthy brain, so you let the process of retaining facts take care of itself. The only thing that remains is recalling the facts stored away.

This, too, will take care of itself if you will remove all distracting elements, the chief of which is emotional disturbance—fear that you will forget. I shall never

(Continued on page 149)

Earn a Trip to California!

Repair autos at home and earn money. National's "Movie-graph" method makes it easy. You can soon make enough to come to California and have choice of many fine jobs now open or go into business for yourself.

Send Now for "Movie-graph" Lessons—**Make Money Right Away!**

You can now begin at home to earn your way to Big Pay in automotive work, with National's remarkable "Movie-graph" lessons before you. You can start immediately toward independence in this fascinating industry, where many of National's 16,000 graduates are earning \$50 to \$100 and more a week.

Actual Training at Home! These lessons are the same as practical work given National students for 21 years in our big \$1,000,000 plant. Now they have been put on paper—on "Movie-graphs"—in such a clear, simple way that you can instantly master them at home. No need to wait till you've saved up money to attend school. Send for these lessons, then earn your money while you learn. We show you how. Over a million cars in California! Motoring every day in the year! Truly the automotive man's paradise! We furnish free employment service. Why wait longer? Never has success been so easy. Every day's delay puts you farther from your goal. Mail the coupon today!

Special Offer! 4 "Movie-graphs" \$1 4 "Auto Repair Jobs for

National Automotive

LOS ANGELES ESTABLISHED 1905
National Automotive School
Dept. 656, 4004 South Figueroa St., Los Angeles, Calif.

CHECK ONE
() I enclose \$1 for the first four "Movie-graphs" of Actual Auto Repair Jobs.
() Send FREE information on how I can earn money at home as an auto expert.

Name
Address
City State

Seal Rupture With a Quarter

Now you can throw away forever steel bands, chafing leg straps and other heavy makeshift devices. For a well known American scientist has found a new easy way to support rupture assisted by means of a wonderful little invention weighing less than 1-25 of an ounce. Not only do you do away with the objectionable pressure and tight strapping, but you eliminate the "coming down" of rupture—when running, straining, exercising, sneezing, etc.—which too frequently leads to strangulation. So great has been the success of this wonderful device that it is being offered to ruptured people on an absolute guarantee of instant satisfaction or no cost. Simply drop a postcard or letter requesting free literature to NEW SCIENCE INSTITUTE 4020 Clay St, Steubenville, Ohio

Study AT Home

Become More Efficient

Courses in Mathematics, Chemistry, Psychology, Education, Business, and 40 other subjects command either High School or College Credit. Start any time.

The University of Chicago
25 Ellis Hall CHICAGO, ILL.

Make BIG Money LEARN STENOGRAPHY TULLOSS NEW WAY

LEARN AT HOME QUICKLY IN SPARE TIME.
Graduates earn \$40 to \$60 a week. SO CAN YOU. Speed of 80 to 100 words a minute in typewriting—125 to 150 words a minute in shorthand guaranteed. Supersedes old methods—easy for anyone.

WRITE TODAY FOR AMAZING OFFER. Entire Course ON TRIAL. Complete business training included. Send for new descriptive Book and limited Special Offer. Act Quickly.

THE TULLOSS SCHOOL, 122 College Hill, Springfield, Ohio

Stop Forgetting

Make Your Mind an Index from which you select facts, figures, names, faces. Develop concentration, self-control, overcome bashfulness, forgetfulness. Write today for FREE memory and concentration test and illustrated booklet, "How to Remember."

PROF. HENRY DICKSON
Dept. 929, Evanston, Ill.

Is Your Memory Really Bad?

(Continued from page 148)

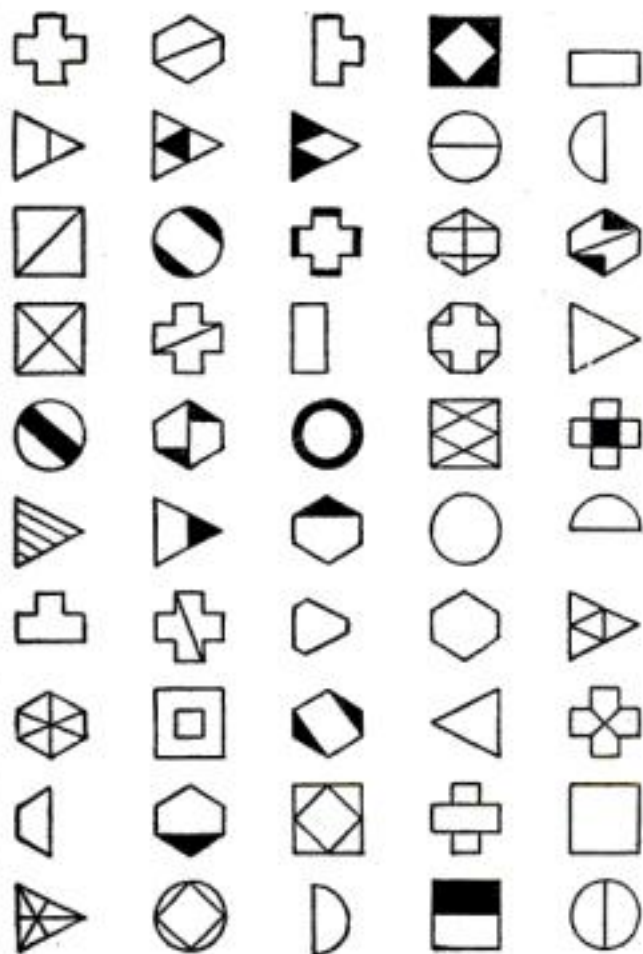
forget the appalling sensation I once experienced on the platform in high school as I waited my turn to give a speech. I was sure I should forget. I did not forget, but the task would have been twice as easy if I had had confidence.

If you can't remember something at first, drop the whole matter and come back to it later. It means that certain connections are established in your brain over the wrong paths. If you back off and rest a while, the wrong track will fade out.

Trust your memory and go right ahead. If the connections are established properly, they will function with ease.

Memory tests concocted in psychologists' laboratories have practical use right here. In themselves they do not improve memory, but they do develop self confidence. Try them on yourself. They will show you that there is nothing the matter with your memory. Your problem is to become a better manager.

The Picture Test



AMONG these 50 forms are hidden the 25 forms shown at the top of page 26. Check as many of the 25 as you can remember. Score one point for each that you remember correctly, and deduct one for each that you mark wrong.

The Word Test

OPPOSITE each of these 10 words write from memory the word with which it is paired on page 26. See how many you can recall:

Prefer.....
Overcoat.....
Tiger.....
Freeze.....
Fish.....
Sickness.....
Table.....
Parlor.....
Expensive.....
Unfair.....

How New Method Makes Cartooning Astonishingly Easy to Learn!

Cartoonists earn from \$50 to over \$250 a week! Why don't you make big money in cartooning when new method makes it so easy to learn—at home in spare time?

THOUSANDS who never dreamed they could make cartoons, can now earn big money in this fascinating field. Right at home in your spare time, you can now easily learn to make all kinds of cartoons—comic, sport, political, human interest and animated. You can now earn some of the big money paid for cartoons of every description.

And cartooning does pay enormous money. Briggs, Bud Fisher, Fontaine Fox, George McManus, Sid Smith and all the other head-liners earn more than the President. A single cartoon idea can easily mean a splendid life-salary for you.

The World's Easiest, Pleasantest and Best Paying Profession

How could money be earned more pleasantly? A few hours a day at work that is as enjoyable as play—and there is almost no limit to the money that can be earned!

Never before have the opportunities in cartooning been so many or so varied. Never has there been such a splendid chance to earn big money for cartoons. And regardless of what you are doing at present or how poorly you draw now, you can easily and quickly learn to make cartoons thru this new easy method.

New Easy Way to Learn Cartooning

It's fun learning to make cartoons this new way. It's just like a game. You learn at home, yet it is just as if an instructor stood at your elbow. You don't need to know a thing about cartooning. You start with straight lines and curves. Then you learn the little secrets of originating cartoon ideas, the methods of exaggeration, of action and expression—all the little tricks that make cartooning amazingly easy to those who know them. And soon you are making real cartoons. Many of our students had cartoons published before they were half thru their courses.

When learning to make cartoons is so easy, why shouldn't you too make big money and enjoy the fun of cartooning.

What Students Say:

I am now working for myself and find all I can do. I find no trouble in cleaning up in the neighborhood of \$250 a week. I have my own syndicate and am gradually branching out into a good field.
R. P.—LAWRENCE, MASS.

Free Employment Bureau

I want to thank you for the personal interest you have taken in me while receiving instruction from your school and for referring me to this magazine.

F. M.—MEMPHIS, TENN.

\$125 a Month Spare Time

I wish to take this opportunity to recommend your school. I have been doing a great deal of commercial work—making on the average of \$125 a month in spare time.

T. W. P.—CHARLOTTE, N. C.



Graduates of this school are to be found in every section of the country. Read in the panel what they are doing and what they say about this training.

Mail Coupon for Free Book

Learn more about the wonderful opportunities for making money in Cartooning and how this new method makes it easy for you to learn. Read about our students, how they make money while learning, and big salaries after they graduate. Our handsomely illustrated booklet is crammed full of interesting facts on Cartooning and describes in detail this remarkable method of teaching Cartooning. It will be sent to you without obligation. Mail the coupon for this booklet now. **Washington School of Cartooning, Room 241-D, 1113 15th St., N.W., Washington, D. C.**

WASHINGTON SCHOOL OF CARTOONING,
Room 241-D, 1113-15th St., N. W.,
Washington, D. C.

Please send me, without obligation, your Free Booklet on Cartooning and full details on your new easy home-study method of teaching Cartooning. (PLEASE WRITE PLAINLY.)

Name.....
(State whether Mr., Miss or Mrs.)

Address.....

City.....State.....

(If under 16, please give age.....)

\$100 in Cash Prizes

See Page 4 in front of book for details

WANTED RAILWAY POSTAL CLERKS MAIL CARRIERS

\$1700 to \$3000 Year TRAVEL—See Your Country MEN—WOMEN, 17 UP SHOULD MAIL COUPON IMMEDIATELY

Steady Work. No Layoffs. Paid Vacations.



FRANKLIN INSTITUTE, Dept. K-278 Rochester, N. Y.
Sirs: Send me without charge: (1) Specimen Railway Postal Clerk Examination questions; (2) FREE book containing list of U. S. government positions open to men and women; (3) Free sample examination coaching.

Name.....

Address.....

THE DANGER OF NERVE EXHAUSTION

Your Nerves can make or break you!

THERE is but one malady more terrible than Nerve Exhaustion and that is its kin, Insanity. Only those who have passed through a siege of Nerve Exhaustion can understand the true meaning of this statement. The victim passes through the most soul-racking tortures; he is in the grip of every conceivable fear.

Nerve Exhaustion is the result of living under conditions of nerve strain. In men it can generally be traced to the strain of business worries and responsibilities, and, more frequently, to excesses; in women, to over-active emotions—particularly in matters of love and marital troubles.

Indeed, we are ALL living under severe nerve strain. We go about the business of bread-winning with a mad intensity, and, in the same way, we go about our pleasures. This is an age of nerve strain and no one is strong enough to be immune to its devastating effects.



PAUL von BOECKMANN

Author of "Nerve Force," and various other books on Health, Psychology, Breathing, Hygiene and kindred subjects.

Nerve Exhaustion does not come suddenly. It creeps in like a thief in the night and you do not know it is there till you are actually in its clutches. When the first symptoms of this malady are upon you, you pay little attention. It is not considered unusual to experience fatigue, lassitude, headaches, nervousness and other symptoms. Yet, surely, they will not stop there. Other stages of Nerve Exhaustion will follow: sleeplessness, irritability, poor assimilation and digestion, constipation, irregular heart, etc.

If you have good nerves, keep them so by learning how others wreck them. If your nerves are deranged, build them up.

Do not wait until the final stages have developed and you are told by your doctor to take a "long vacation" or confined to your bed for months of "rest" with drug stimulants and sedatives to keep you from "jumping out of your skin." The time to act is when you are advised that "there is nothing the matter with you"—except nerves—and yet you KNOW THERE IS SOMETHING THE MATTER.

Nerve Trouble or no nerve trouble, you should have a knowledge of the functioning of your Nervous System.

Read "Nerve Force," a 64-page book on the care of the nerves. This book is a startling revelation to people with sensitive or deranged nerves. It has aided many thousands to gain control of their nerves and build up their Nerve Force. Price, 25c postpaid. (Coin or stamps.)

Address PAUL VON BOECKMANN
110 West 40th Street, Studio 161,
New York City.

Here Are Correct Answers to Questions on Page 41

1. During the first six months. The increase in height is usually about five per cent a month. In weight it is about 20 per cent a month.

2. They contain an oily chemical that evaporates, very irritating to the delicate membrane of the eye. The watering is an attempt of the eye to wash away the irritation.

3. Precious stones are merely crystallized minerals. They are formed in rocks by slow crystallization of the proper mineral.

4. When the gun is fired, the powder turns into gas. The gas takes up much more room than the powder did and that is what drives the bullet out of the gun. When the bullet leaves the gun, the gas behind it escapes suddenly and sets up a sound wave. This is what we hear as the bang.

5. A broadcasting station does not send out merely a wave corresponding exactly to the sounds that it intends to broadcast. Instead, the fundamental thing that the broadcasting station sends out is a radio wave of uniform frequency, this frequency being the specified one for that station. This fundamental wave is called the "carrier wave." The sound message is superposed on it.

6. The water inside the living cells freezes and this bursts the cells so that they die.

7. It is made of nitroglycerine mixed with some absorbent material, as clay or sawdust. The atoms of nitroglycerine are fastened together very loosely. On the slightest provocation they fly apart and the nitroglycerine explodes violently. The clay or sawdust divides up the nitroglycerine so that it is not quite so violent. This makes it safer to handle.

8. When a cat is frightened or angry he ruffles up the hair of his body and tail in order that he may appear to be more dangerous. The cat does this by a chemical discharged by his adrenal glands.

9. Strictly speaking, there is not; though at the center of the earth things would weigh very little. Weight is due to the attraction of gravity. At the center of the earth the attraction due to the matter of the earth would disappear, but there still would be some slight weight due to the attraction of gravity of the sun, the moon and the other heavenly bodies.

10. Because when it was formed the matter that gathered together was revolving, probably because the attraction of the passing star started it off. The earth has simply kept on spinning as a top would spin if there were no friction of any kind to make it stop.

11. A scorpion, not very different from modern scorpions. In the Silurian period, four or five hundred million years ago, there were a lot of scorpions living in the ocean. Some of them finally learned to live ashore.

12. Very few people take exactly equal steps with their two legs. In ordinary walking we correct this automatically whenever necessary because we can see where we are going.

BE A RAILWAY TRAFFIC INSPECTOR

MEN WANTED! Earn Up To \$250 PER MONTH EXPENSES PAID



Fascinating profession demands more trained men. Steady work and experience leads to advancement. Meet big railway officials. Travel or remain near home.

We Secure Position For You upon graduation, paying at least \$110 per month, or refund your money. You can prepare in 3 months spare-time home study. Easy to understand.

Hundreds of Successful Graduates recommend our course. Big opportunities ahead. Send coupon for full details.

Standard Business Training Inst., Buffalo, N. Y.

Send me, entirely free, Booklet No. D-64, giving full particulars about course in Railway Traffic Inspection.

Name _____
Street _____
City _____

Art and Life A Magazine of ART

Nothing like it!

Stands for the BODY BEAUTIFUL, Mind Intellectual, Soul Intuitive. Proclaims the Invisible Brotherhood.

Lessons in art and photography. Contests and criticism.

In each issue from 48 to 64 big pages of beautiful Roto-print reproductions of famous paintings, statuary, Lense art photos of the Human Figure, birds, animals, etc.

Educational, clean, uplifting, interesting.

A sane and helpful philosophy of living and of life. For Art and Nature lovers, students, teachers, THINKERS, and all who wish to develop their powers of body, mind and soul.

Thousands of testimonials like this—
I must say it is one of the most wonderful magazines printed, and I have not missed any copies for the last three years. J. C. M., Cottam, Ont.
From the time you started the magazine, years ago, it has been a source of inspiration to me. C. C. D.

Can't be described. YOU must see it.
You can't lose. O.K. or money refunded.

CUT THIS OUT and send with \$2.50 for yearly sub, or \$1 for 4 Mo. Trial Sub. (No free samples.)

ART AND LIFE, Dept. 2606 Kalamazoo, Mich.

DRAW CARTOONS

TURN YOUR TALENT INTO MONEY

Cartoonists earn from \$50 to \$300 per week—some even more. Remarkable new Circle System of Drawing teaches you in half the usual time. Send for booklet and sample lesson plate explaining full details of the Course.

THE NATIONAL SCHOOL OF CARTOONING
415 Park Building Cleveland, Ohio



SAVE 1/3 TO 1/2!

Everything in Radio

WRITE FOR CATALOG—FREE

RANDOLPH RADIO CORP.
159 N. UNION AV. Dept. 3 CHICAGO, ILL.

LEARN FURCRAFT

Free book shows how you can quickly learn to repair, renew and make up all kinds of fur garments at home. Big need for this service in every locality. Save money on your own furs and make \$3.00 an hour in spare time. Write now. No obligation. Book is free.

NORTHWESTERN FUR CO., 1781 Sunderland Bldg., Omaha

Getting Ahead?

Read the advertisements on Pages 120 to 150 of this issue if you want to get ahead!

This One



AFKL-4D3-LA1Z

Send for this RADIO BOOK FREE

**The World's Largest
Exclusive Radio Mail Order
House Will Send You This
Wonderful Book FREE!**

64 illustrated pages containing thousands of bargains in radio sets, semi-finished sets and radio kits of all styles, sizes and approved circuits. 5-tube sets as low as \$29.50. Beautiful models of the very latest designs and types. Elaborate console models with loud speakers built right in cabinets of genuine mahogany and walnut. All sets guaranteed. Coast to coast receiving range. Also contains everything in radio supplies, including batteries, chargers, loud speakers, transformers, condensers, rheostats and any other parts you may want for improving your set or building a new one. Guaranteed saving to you of $\frac{1}{3}$ to $\frac{1}{2}$.

The Biggest 5-Tube Value on the Market

Positively the world's greatest 5-tube radio bargain. Regular \$75.00 value. Our large quantity production enables us to sell this set for only \$29.50, fully built and wired in beautiful mahogany cabinet of latest design with sloping Bakelite panel of Satin finish, handsomely etched and engraved as illustrated. Constructed of the finest low-loss condensers, coils and sockets. Bakelite baseboard panel and dials. Price for set only..... **\$29⁵⁰**

Transportation charges extra. Shipping weight 25 lbs.

This set with all Accessories, including the famous American Bell Loud Speaker with adjustable unit, 2-45 volt "B" batteries, one guaranteed 100 Ampere Hour storage "A" battery, cable for battery connection, 5-201A tubes, Aerial and ground equipment, and everything complete ready to set up and operate. Nothing else to buy. Price..... **\$59⁷⁵**

Transportation charges extra. Shipping weight 100 lbs.

Order Direct From This Page! Save $\frac{1}{4}$ to $\frac{1}{2}$. Sets on this page are typical examples of bargains throughout our catalog. Our guarantee protects you. Money cheerfully refunded if you are not satisfied. Write your order and prices plainly. Send post office money order or bank draft for full amount to insure safety. Refer to any bank or commercial agency regarding our reliability.

Columbia Grand 5-Tube Console Set

\$57⁹⁵



Console Radio with built-in loud speaker and adjustable unit. Has compartments for storage "A" and "B" batteries, battery charger, radio book of instructions, etc.

Beautiful Walnut Cabinet in two-toned effect. Two door panels inlaid with highest grade burl walnut. Cabinet is 39 inches high. Top measures 13x37 inches. Equipped with high-grade built-in loud speaker with adjustable unit. Large, roomy interior for holding all batteries, books, etc. The Columbia Grand is a 5-tube tuned radio frequency receiver. Coast to coast receiving range. Tune in stations desired—very selective. Has latest type, low-loss condensers, coils and sockets. Bakelite baseboard, sockets and dial knobs. Dials are beautifully etched in gold on walnut finish bakelite panel. Price for set only, fully built and wired—\$57.95.

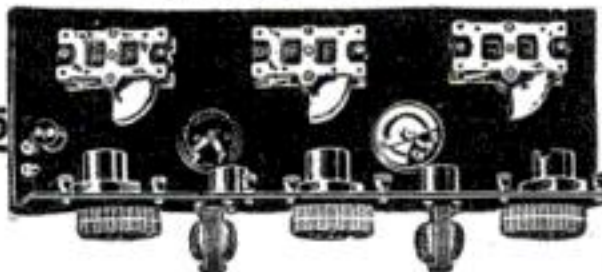
Transportation charges extra. Shipped by freight or express.

This set with all accessories, which include 2-45 volt "B" batteries, one guaranteed 100 ampere hour storage "A" battery, 5-201A tubes, multicolored cable for easy battery connection, aerial and ground equipment, instructions for setting up and operating—everything complete, nothing else to buy—\$84.95

Transportation charges extra. Shipped by freight or express.

Semi-Finished 5-Tube Radio Frequency Set

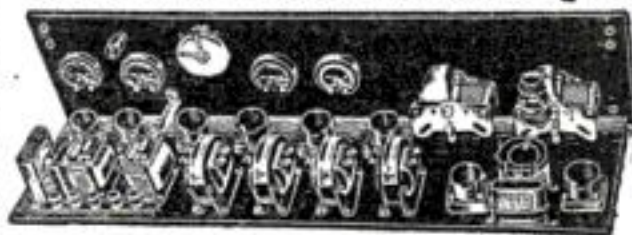
\$18⁷⁵



This special offer is astounding the radio world. Coast to coast reception on loud speaker. Low-loss condensers and sockets. Highest quality transformers. Bakelite rheostats. All wiring concealed under Bakelite baseboard. 7x18 panel—fits into any standard 7x18 cabinet. Complete instructions for operating. Guaranteed saving to you of \$50.00. Price of set all mounted, \$18.75. Cabinet of same model as American Radynola pictured above \$5.65 extra.

Semi-Finished 8-Tube Super-Heterodyne

\$43⁷⁵



World's Famous 8-tube Super-heterodyne. Fully mounted on panel and baseboard. Comes Completely assembled ready to wire and operate. We have testimonials from thousands of builders of this set. Some have received foreign stations on loop aerial. Unsurpassed in volume and tone quality. Low-loss straight line frequency condensers, vernier dials, finest quality rheostats. Matched Columbia long wave transformers. Requires only three screws for attaching panel and baseboard and set is ready to wire and operate. 7x30 panel. Price of set only \$43.75.

Requires following accessories to complete this set: 7x30 cabinet, 8-201A tubes for storage battery operation or No. 199 tubes for dry cell operation, 100 Ampere hour storage battery, 2-45V "B" batteries, loud speaker, center tapped loop aerial. All these items are listed in our catalog, at a tremendous saving.

Our semi-finished sets come with all parts mounted on panel and baseboard ready for wiring. Do not fail to send for our catalog. Remember—we are the largest exclusive radio mail order dealers in the world and carry the best of everything in radio. We save you 1-3 to 1-2 on everything in radio. Detailed descriptions appear in our catalog.

Our line is complete, includes all popular sets, such as Superheterodyne, Neutrodyne, Ultradyne, Reinartz, Regenerative, Radio Frequency, Brown-Drake, Super-Heterodyne Reflex and all other latest circuits. Kits, sets and parts by well-known manufacturers such as Frost, Howard, Baldwin, Brandes, Western Electric, Columbia and others.

ULTRADYNE

Complete parts for 8-Tube Ultradyne receiver, without cabinet, complete with blueprint, instructions and diagrams

\$45.85

NEUTRODYNE

Genuine Licensed Neutrodyne kit of parts come fully assembled on the panel and baseboard with complete instructions ready to wire

\$29.75

ULTRA-AUDION

One-tube Ultra-Audion. Wizard of radio. Fully assembled and ready to wire, with instructions

\$6.35

COCKADAY

3-tube Cockaday kit of parts, fully assembled on panel and baseboard ready to wire

\$15.85

BROWNING DRAKE

4-tube complete low-loss parts

\$32.40

REMLER 8-TUBE SUPER HETERODYNE

Complete parts for Best 45 Kilocycle Super-Heterodyne Genuine Remler parts

\$49.50

HARKNESS

2-tube reflex kit of parts, fully assembled on panel and baseboard, ready to wire, complete instructions

\$16.95

Catalog includes list of broadcasting stations, general radio information and facts about our free service division. Write for it today.

RANDOLPH RADIO CORPORATION
159 N. Union Ave. Dept. 223 Chicago, Illinois

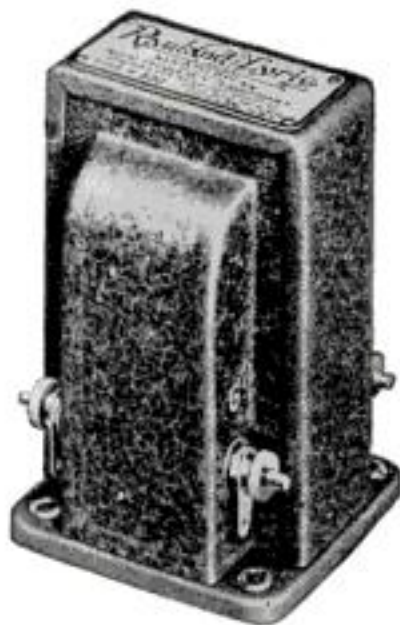
OUR GUARANTEE
Every article exactly as represented. Every article tested before shipping. Complete satisfaction guaranteed.



When a Finer Transformer Is Made It Will Bear This Name-Plate

Radio moves rapidly. Perhaps some time there may be seen a *better* transformer than what we *now* know as Rauland-Lyric. It may sell at \$9, or \$10, or \$15, or \$7. But the careful observer of the past year's developments will entertain not a moment's doubt of one thing: when the better transformer comes it will come beneath the famous Rauland-Lyric name-plate. Behind this as a pledge rests the entire organization and resources of the All-American Radio Corporation

Rauland-Lyric is easily obtainable from better-class dealers everywhere. The price is nine dollars. Descriptive circular with technical data may be had on request to All-American Radio Corporation, 4201 Belmont Avenue, Chicago



Rauland-Lyric tone quality is now available in a complete receiver: the new All-American Model R (a five-tube tuned-radio-frequency set) now being shown. If your preferred dealer does not display it, send to us for descriptive booklet

Shave every day—be comfortable

COLGATE'S

softens the beard at the base



YESTERDAY —

There are logical reasons for the disappearance of the whiskers that used to ripple o'er the bilateral conformations of the manly countenance.

When people invested money in buggies and tin bathtubs it was neither dangerous nor uncommon to display facial outcroppings; but this is an age of speed, and some things cannot conveniently be associated with velocity.

Proceeding at thirty miles an hour, a man with swishing side-whiskers might easily become involved in embarrassing entanglements. With his pilary encumbrances flapping like pennants in a storm, he would offer an immediate challenge to any motorcycle cop who might be inclined to pull him in.

There was a time when the proprietor of a rippling beard was justified in regarding it as a measure of self-defense; but that was when shaving was justly considered a major operation—when there was nothing like Colgate's Rapid-Shave Cream for making lather. The



— TODAY

advantage of shaving every day becomes apparent when a picture of the man of affairs balanced between his former side-flaps is brought into contrast with the smart appearance he presents today.

Like millions of others, this man lathers with Colgate's because there is nothing that equals it for putting comfort into shaving. The moist, fine lather, goes to the base of the hair and softens it instantly where the razor's work is done.

There is no need of mussy rubbing in with the fingers. Working up the lather on the face with a wet brush is sufficient to make the heaviest beard yield easily to the blade.

Colgate's leaves the face cool and refreshed.

Let us send you a trial tube of this marvelous cream for better shaving. Please use the coupon and enclose 4c.

Colgate's
Est. 1806 NEW YORK

In Canada
COLGATE & CO., 72 St. Ambrose St., Montreal



A coarse inefficient lather, which fails to reach the base of the hair.

Colgate's fine texture lather, which softens the hair at the base.

COLGATE & CO.
Dept. R
581 Fifth Ave., New York

Please send me the trial tube of Colgate's Rapid-Shave Cream for better shaving. I enclose 4c.

Jan-26

Name.....

Address.....

Truth in advertising implies honesty in manufacture